PB86-224854

Superfund Record of Decision (EPA Region 3)
Leetown Pesticide Site
Jefferson County, West Virginia, March 1986

(U.S.) Environmental Protection Agency
Washington, DC

31 Mar 86

U.S. Department of Commerce
National Technical Information Service
NTIS

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R03-86/022
March 1986

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EPA

Superfund Record of Decision:

Leetown Pesticide, WV

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16. ABSTRACT

The Leetown Pesticide site is located in northeast West Virginia, approximately 8 miles south of Martinsburg, West Virginia. The "site" is actually composed of a number of areas affected by surface disposal of pesticides, agricultural use of pesticides, and landfilling. A total of eight specific areas of waste disposal or accumulation were identified during the initial RI study. Of these eight areas, two were the result of alleged disposal of pesticide-contaminated debris from a fire that occurred in 1975 at the Miller Chemical Company. These two areas include the former pesticide pile and the suspected pesticide landfarm areas. Four of the contaminated areas are associated with former use of the land for orchard production. The two remaining sites are active landfills.

The results of the contaminant release and exposure study indicate that the suspected landfarm and apple orchards do not appear to comprise significant sources of environmental contamination. The only three areas out of the eight investigated that present concentrations of pesticides above ambient soil background (non-pesticide use areas) and orchard background levels (pesticide application areas) are the following:

- Former Pesticide Pile Area (presently: Robinson Property)
- Former Jefferson Orchard Mixing Area (presently: Robinson Property)
- Former Crimm Orchard Packing Shed (presently: Tabb Barn)

(See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Leetown Pesticide, WV Contaminated Media: soil, sediments Key contaminants: pesticides, organics, inorganics		

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16. ABSTRACT (continued)

The selected remedial action for this site includes: excavation and consolidation of approximately 3600 cubic yards of contaminated soil from the three areas mentioned above; placement of these soils in an onsite "treatment bed" to enhance anaerobic biodegradation of the pesticide contamination; removal and offsite disposal of the contaminated flooring, a wooden spray wagon, and drums of pesticide product in a permitted hazardous waste facility; construction of a monitoring well network; and construction of surface water diversion systems, sedimentation channels, and diversion dikes. Total capital cost for the selected remedial alternative is estimated to be $1,014,000 with O&M costs approximately $10,000 for the first year and $7,500 for the second.

RECORD OF DECISION
Remedial Action Alternative Selection

Site: Leetown Pesticide Site, Jefferson County, West Virginia

Documents Reviewed

The underlying technical information, unless otherwise specified, used for analysis of cost-effectiveness and feasibility of remedial alternatives is included in the following documents and project correspondence. I have been briefed by my staff of their contents, and they form the principal basis for my decision of the appropriate extent of remedial action.

- "Remedial Investigation Report" (Draft), Leetown Pesticide Site, Jefferson County, West Virginia (NUS Corporation, February 1986)
- "Feasibility Study of Alternatives" (Draft), Leetown Pesticide Site, Jefferson County, West Virginia (NUS Corporation, February 1986)
- Recommendations by the West Virginia Department of Natural Resources.
- Staff summaries and recommendations, including the attached "Summary of Remedial Alternative Selection, Leetown Pesticide Site".

Description of the Selected Remedy

- Excavation and consolidation of approximately 3,600 cubic yards of contaminated soil from three separate contaminated areas (Former Pesticide Pile Area; Former Pesticide Mixing Area and the Former Crimm Packing Shed Area)
- Placement of these soils in a "treatment bed", constructed on the site near the Former Pesticide Pile Area. Treatment of these soils to enhance anaerobic biodegradation of the pesticide contamination.
- Removal and disposal in a permitted hazardous waste facility of the contaminated flooring, a wooden spray wagon, and drums of pesticide product. The preferred off-site disposal method for the drums of pesticide product is incineration.
- Construction of a monitoring well network upgradient and downgradient of the treatment bed area. It is estimated that 6 downgradient and 2 upgradient wells will be sufficient for ground water monitoring during and subsequent to treatment operations.
- All ancillary construction necessary to support site activities. These include: construction of temporary access roads, decontamination pads, surface water diversion systems, sedimentation channels and diversion dikes.
- Any field testing and/or laboratory bench scale testing needed to verify soil conditioning material and quantity for maximizing biodegradability within the treatment bed. These bench tests will be performed in a pre-design phase.

Operation and Maintenance

Operation and maintenance (O & M) will be initiated by the State of West Virginia one year subsequent to the completion of the remedial actions. Remedial actions will be considered completed when target DDT levels are reached in the treated soils. Since this a "clean closure" type of operation, the only state conducted O & M anticipated will be two years of ground water monitoring in the well network constructed around the treatment bed.

Visual inspections will also be necessary to assure that the restoration of the treatment area, subsequent to remedial action, is effective.

Declaration:

Consistent with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) and the National Contingency Plan (40 CFR Part 300), I have determined that the remedial actions described above, together with proper operation and maintenance, constitutes a cost-effective remedy which mitigates and minimizes damage to the public health, welfare and the environment. The remedial actions will be designed to minimize any temporary inconveniences to the local population during the construction phase.

The State of West Virginia has been consulted and agrees with the approved remedy. One year following the completion of the remedial action, operation and maintenance in the form of ground water monitoring will be conducted by the State in order to assure the effectiveness of the remedy. The State will also be responsible for visual observation of the restored treatment area to assure proper vegetation has occurred and erosion of the soils is not taking place.

I have determined that the action being taken is appropriate when balanced against the availability of Trust Fund monies for use at other sites.

March 31, 1986
Date

James M. Seif
Regional Administrator
EPA Region III

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- Responsiveness Summary
- Enforcement Status
  (Enforcement Confidential-may be removed from public copies)

Summary of Remedial Alternative Selection

Leetown Pesticide Site

A. Site Location and Description

The Leetown Site is located in extreme northeastern West Virginia approximately 8 miles south of Martinsburg, West Virginia.

The "site" is actually composed of a number of areas of concern relative to surface disposal of pesticides, agricultural use of pesticides, and landfilling. The study area has been defined as the Bell Spring Run and Blue and Gray Spring Run watersheds from the areas of contamination to the points of interest (i.e. potential receptors), as shown in Figure 1.

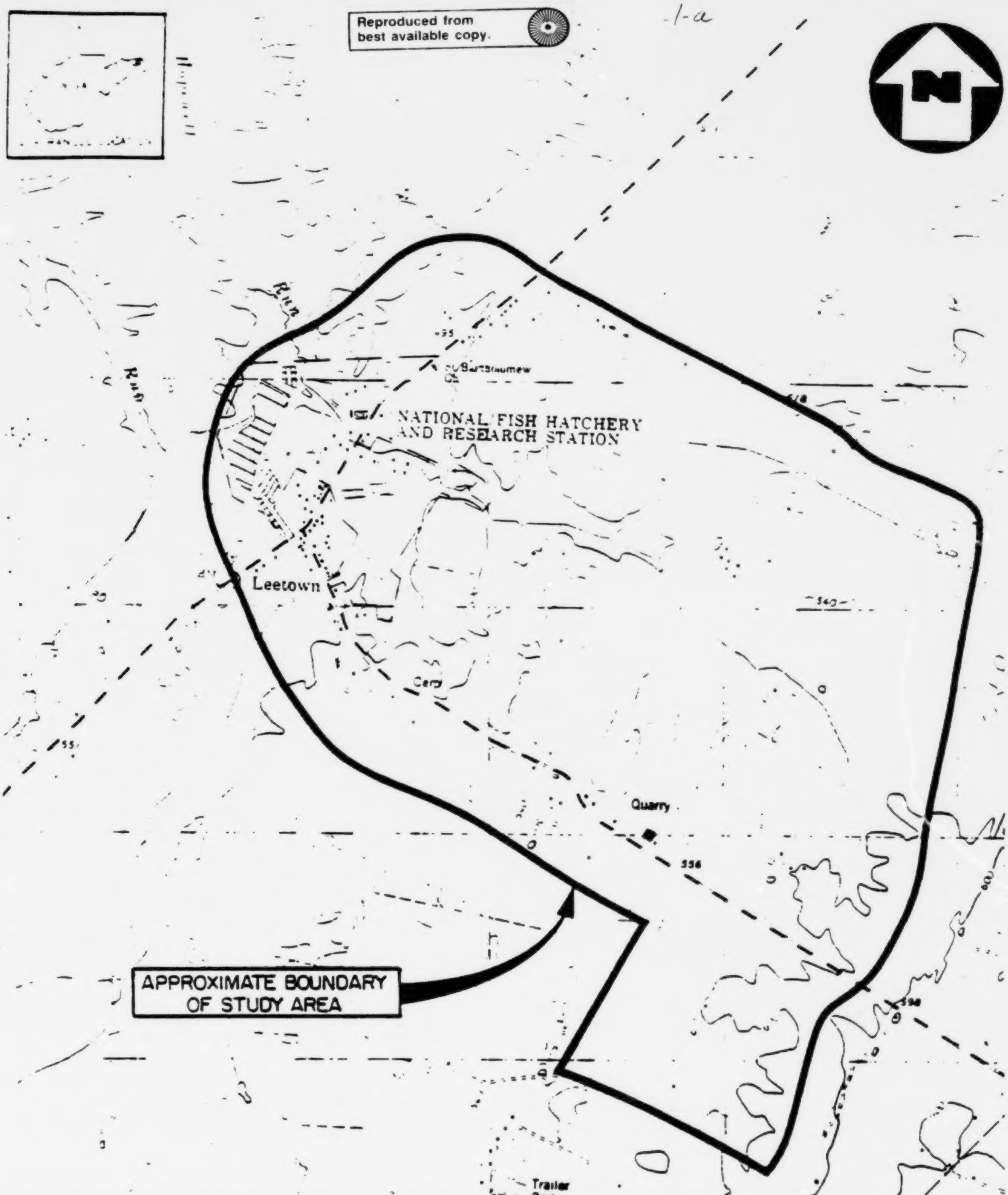
Land use in the study area is predominantly agricultural, dedicated to pasture or forage/rowcrop production for dairy cattle operations. This is in contrast to orchards, which were the prevalent land use in the area in the past. Habitat suitability for terrestrial wildlife and avifauna is restricted by the agricultural development. The upper reaches of the Bell Spring Run watershed are predominantly dedicated to pasture and rowcrop production. This portion of the study area also encompasses the potential sources of environmental contamination. Fencerows within the developed agricultural areas, as well as areas not presently being managed for pasture or crop production, frequently support dense growths of brambles that provide food, nesting, and escape cover for small mammals.

Small woodlots (less than 50 acres) may be found in the lower reaches of the watershed. In this vicinity they are accompanied by the most significant wetlands found in the study area. The latter are found on the lower reaches of Bell Spring Run, near National Fisheries Center (NFC) Reservoir A, and in the vicinity of Gray Spring Run. These wetlands have been mapped by the West Virginia Department of Natural Resources, Wildlife Resources Division (WVDNR WRD), as Marsh No. 75, or the Hopewell Marsh, although they do not communicate. The northern component of the marsh occupies an area of 17 to 20 acres on Bell Spring Run, while the southern component is a more nondescript area within the immediate recharge zone of Gray Spring.

The occurence of potential sources of contamination in the Leetown area may be associated with one or more of three distinct activities: 1) agricultural use of pesticides; 2) pesticide disposal; and 3) landfilling activities. A total of eight specific areas of waste disposal or accumulation were actually identified during initial RI study, as shown in Figure 2.

Of these eight areas, two were the result of alleged disposal of pesticide-contaminated debris from a fire that occurred in 1975 at the Miller Chemical Company in nearby Ranson, West Virginia. These included the former pesticide pile area and the suspected pesticide landfarm area, Areas 2 and 4, respectively, on Figure 2.

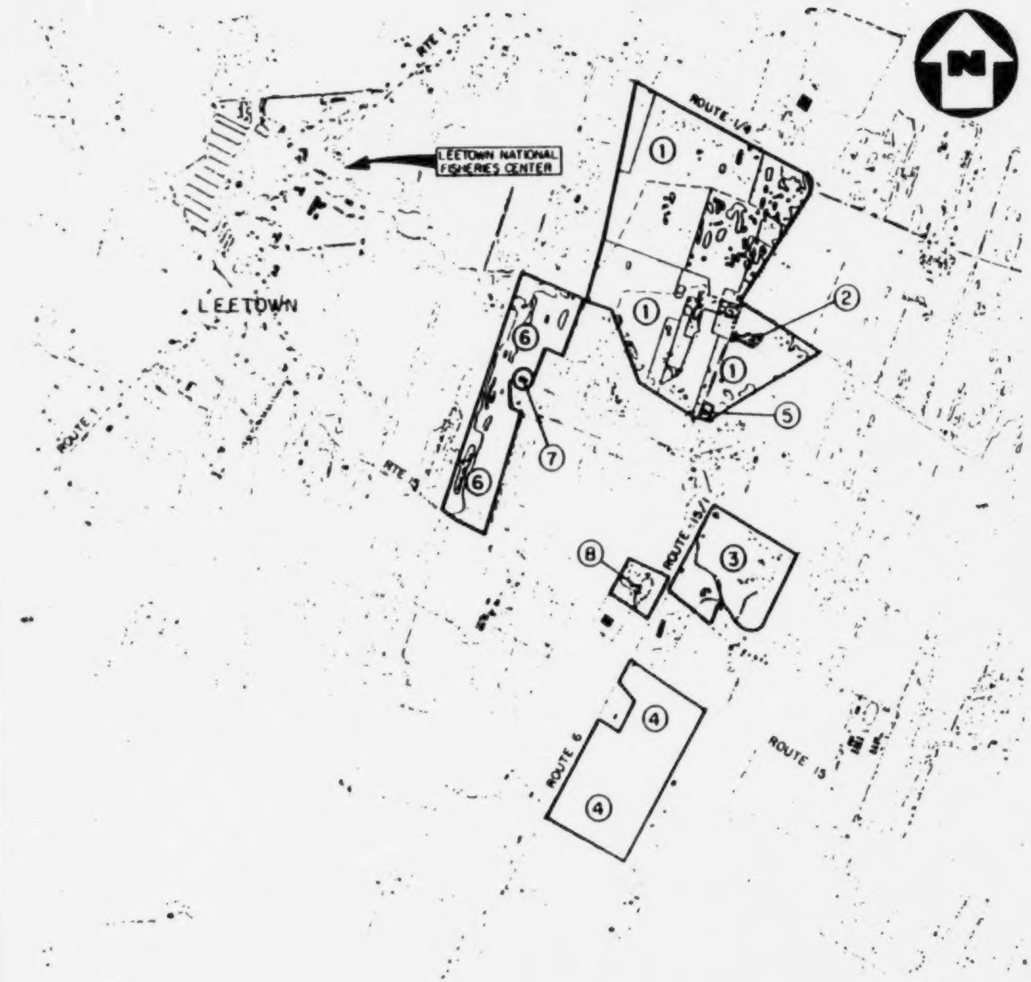
Reproduced from best available copy.


N
Run
Run
St Bartholomew Ch
NATIONAL FISH HATCHERY AND RESEARCH STATION
Leetown
Cem
540
Quarry
556
598
600
Trailer Park
APPROXIMATE BOUNDARY OF STUDY AREA

BASE MAP IS A PORTION OF THE U.S.G.S. MIDDLEWAY, WV QUADRANGLE (7.5 MINUTE SERIES, 1978). CONTOUR INTERVAL 20'.

Figure 1

LOCATION MAP
LEETOWN PESTICIDE SITE, LEETOWN, WV
SCALE: 1" = 2000'


N
ROUTE 1/9
RTE 1
LEETOWN NATIONAL FISHERIES CENTER
LEETOWN
ROUTE 1
RTE 13
ROUTE 13/1
ROUTE 6
ROUTE 13
①
①
①
②
③
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⑤
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⑥
⑦
⑧

LEGEND

▭ POTENTIAL CONTAMINANT SOURCE

① FORMER JEFFERSON ORCHARD

② FORMER PESTICIDE PILE AREA

③ JEFFERSON COUNTY LANDFILL

④ SUSPECTED PESTICIDE LANDFARM

⑤ FORMER JEFFERSON ORCHARD PESTICIDE MIXING SHED

⑥ FORMER CRIMM ORCHARD

⑦ FORMER CRIMM ORCHARD PACKING SHED

⑧ WVDOH MAINTENANCE GARAGE

PLANIMETRIC BASE MAP PREPARED BY EPA ENVIRONMENTAL PHOTOGRAPHIC INTERPRETATION CENTER, DATE OF PHOTOGRAPHY: DECEMBER 4, 1984

Figure 2

0 1500 3000
SCALE IN FEET

DEFINITION OF POTENTIAL CONTAMINANT SOURCES
LEETOWN PESTICIDE SITE, LEETOWN, WV

1-b

Four of the contaminant sources are associated with former use of the land for orchard production. The Jefferson Orchard formerly occupied an area of approximately 170 acres on both sides of Route 15/1. This orchard was operated by Mr. John F. Ambrose from its purchase in 1937 until the late 1950s or early 1960s. The segment of the orchard to the east of Route 15/1 was sold to John F. and Luola G. Robinson in 1966. The present ownership of the tract to the west of Route 15/1 lies with the U.S. Fish & Wildlife Service (USF&WS), represented locally by the Leetown National Fisheries Center.

A pesticide mixing shed (Area 5, Figure 2) was located at the intersection of Route 15/1 and Bell Spring Run, at the extreme southwestern corner of what is now the Robinson property. This shed was used during the active operation of the Jefferson Orchard to formulate pesticides. One of the apparent reasons for its proximity to Bell Spring Run was to provide a ready source of water with which to slurry the powdered pesticides for spray application.

A second abandoned orchard, the Crimm Orchard, was located on lands now belonging to Mr. Lyle C. Tabb III. This site has been noted as Area 6 on Figure 2. A former orchard packing shed presently stands approximately in the middle of Area 6 and has itself been identified as Area 7 in the figure. In addition to serving as a packing shed for processing of the crop from the orchard, the eastern protion of this shed was apparently used for formulation of pesticides for application at the Crimm Orchard. The EPA was first made aware of the presence of drummed materials in the shed during the summer of 1984 by its present owner, Mr. Lyle C. Tabb III.

The two remaining sites are active landfills. Area 3 is the Jefferson County Landfill, which has been in active operation since 1967 and has been under the control of the Jefferson County Commission since 1972. The landfill presently occupies about 37 acres, about 70 percent of which has been backfilled and reclaimed to vegetation. The operation is advancing from west to east and, while its estimated life in 1984 was only 5 years, expansion onto adjacent land owned by Jefferson County could extend its life for another 30 years or more.

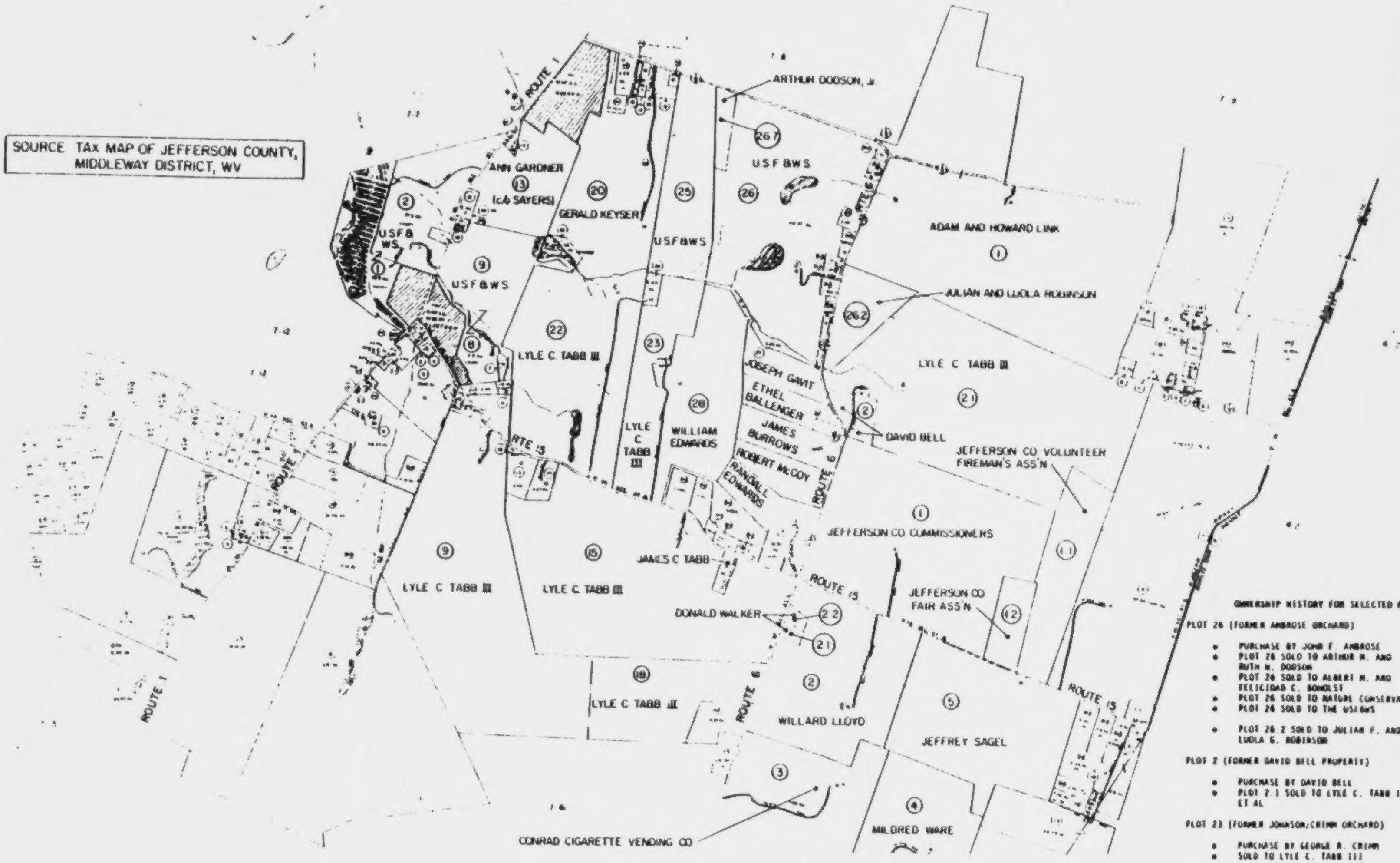
The second landfill within the study area has been noted as Area 8 and is associated with the West Virginia Department of Highways (WVDOH) maintenance garage at the intersection of Routes 15 and 15/1. Although this area may have been a local dump prior to the development of the Jefferson County Landfill, its use is presently restricted to the WVDOH. Access is controlled via a chain-link fence. The access gate is locked whenever the maintenance garage is closed.

B. Site History

An understanding of the historical development of these potential source areas is valuable in establishing an overall perspective. As an introduction, however, Figure 3 identifies present land ownership within the study area, and traces historic ownership for several plots of interest.

-2-a

SOURCE TAX MAP OF JEFFERSON COUNTY, MIDDLEWAY DISTRICT, WV


N
ROUTE 1
ANN GARDNER
13
(c/o SAYERS)
20
GERALD KEYSER
25
USF&WS
267
USF&WS
26
ARTHUR DODSON, Jr.
ADAM AND HOWARD LINK
1
JULIAN AND LUOLA ROBINSON
262
2
USF& WS
9
USF&WS
22
LYLE C. TABB III
23
LYLE C TABB III
28
WILLIAM EDWARDS
JOSEPH GAVIT
ETHEL BALLENGER
JAMES BURROWS
ROBERT McCOY
RANDALL EDWARDS
RTE 6
ROUTE 6
2
DAVID BELL
21
LYLE C TABB III
JEFFERSON CO VOLUNTEER FIREMAN'S ASS'N
1
JEFFERSON CO COMMISSIONERS
11
8
RTE 15
9
LYLE C TABB III
15
LYLE C. TABB III
JAMES C TABB
ROUTE 15
JEFFERSON CO FAIR ASS'N
12
DONALD WALKER
22
21
2
WILLARD LLOYD
5
JEFFREY SAGEL
18
LYLE C TABB III
3
4
MILDRED WARE
CONRAD CIGARETTE VENDING CO
ROUTE 15
ROUTE 1
0
1500
3000
SCALE IN FEET

OWNERSHIP HISTORY FOR SELECTED PLOTS

PLOT 26 (FORMER AMBROSE ORCHARD)

• PURCHASE BY JOHN F. AMBROSE	12/10/37
• PLOT 26 SOLD TO ARTHUR R. AND RUTH W. DODSON	10/27/66
• PLOT 26 SOLD TO ALBERT M. AND FELICIDAD C. BONOLST	02/20/77
• PLOT 26 SOLD TO NATURE CONSERVANCY	04/30/80
• PLOT 26 SOLD TO THE USF&WS	03/06/84
• PLOT 26.2 SOLD TO JULIAN F. AND LUOLA G. ROBINSON	10/27/66

PLOT 2 (FORMER DAVID BELL PROPERTY)

• PURCHASE BY DAVID BELL	12/07/22
• PLOT 2.1 SOLD TO LYLE C. TABB III, ET AL	12/05/75

PLOT 23 (FORMER JOHNSON/CRIMM ORCHARD)

• PURCHASE BY GEORGE R. CRIMM	01/29/51
• SOLD TO LYLE C. TABB III	08/24/66

LAND OWNERSHIP MAP
LEETOWN PESTICIDE SITE, LEETOWN, WV

Reproduced from best available copy.

Figure 3

With the exception of residential parcels along roadways, most of the land in the interior of the watershed is presently held by the U.S. Fish & Wildlife Service (USF&WS), represented locally by the Leetown National Fisheries Center (NFC), Julian and Luola Robinson, Jefferson County, Willard Lloyd, William Edwards, and Lyle C. Tabb III. Most of the land is devoted to pasture or to the production of grain and/or silage corn and small grains in rotation for dairy cattle feed.

Historically, agricultural use of pesticides refers primarily to the use of DDT as a spray application to control insect damage to fruit. Two orchards existed in the watershed at one time. The largest of these was the Jefferson Orchard, operated by Mr. John F. Ambrose on lands now belonging to the USF&WS and the Robinsons. Mr. Ambrose purchased plot 26 (reference Figure 3) on December 10, 1937. According to local accounts, the orchard was limited to this tract of land, on both sides of Jefferson Road (Route 15/1). A pesticide mixing shed was located at the intersection of Jefferson Road and Bell Spring Run on the eastern side of the roadway. Present remains of this shed include the stone foundation (approximate dimensions: 50 feet square) for the first floor and a 12-foot square concrete pad on the southern end of the foundation. The northern exposure of the foundation is keyed into the topography, while a wall consisting of 10 courses of concrete blocks separates the foundation from the concrete pad. No superstructure for the building persists, although steel pipes, approximately 8 feet on-center, protrude slightly from the concrete wall adjacent to the pad. This mixing shed was apparently used to formulate all of the pesticides used the the Jefferson Orchard.

In the late '50's or early '60's the Jefferson Orchard was abondoned. At that time Mr. Amrose apparently pastured beef cattle on the property before selling the portion of plot 26 to the west of Jefferson Road to Mr. Arthur Dodson, Sr., and plot 26.2 to John F. and Luola G. Robinson. Both of these transactions took place on October 27, 1966. Mr. Dodson operated the property as a dairy farm until is death, at which time the operation of the farm was taken over by his nephew, Mr. Roy F. Dodson. Mr. Arthur Dodson's son, Arthur, Jr., presently resides on plot 26.7, acquired in 1974.

Plot 26 was purchased by Albert M. and Felicidad C. Boholst on December 20, 1977, from the Dodsons, who subsequently conveyed the parcel to the Nature Conservancy on April 30, 1980 and to the USF&WS on March 6, 1984. Mr. Roy Dodson continues to operate the dairy farm, leasing the land from the USF&WS through the NFC.

The second orchard in the watershed was the former Crimm Orchard, purchased as plot 23 by George R. Crimm on January 29, 1951. A packing shed was located on a hilltop in the central portion of this tract. The timber structure still remains, and is used by Mr. Lyle C. Tabb III as a storage building for hay and straw. Mr. Tabb purchased plot 23 from Mr. Crimm on August 24, 1966.

The Crimm Orchard Packing Shed was apparently used for pesticide formulation, as well as for preparation of the crop for shipment. Drums containing liquid pesticide formulations, and bags of powdered materials such as guthion and dinitro-ortho-cresol were discovered by Mr. Tabb in the eastern portion of the structure in the summer of 1984. Mr. Tabb notified EPA of his finding.

In response to this notification, the U.S. EPA conducted an assessment for removal action at this packing shed. After careful analysis and considering recommendations from the Centers for Disease Control, the EPA determined that no immediate threat was presented by the contamination and no removal action was warranted. Subsequently, this area was added to the "Leetown Site" for remedial consideration, since it was within the boundaries of the study area.

Pesticide disposal areas are distinguished from areas of agricultural application of pesticides within the watershed. Residue containing pesticides was allegedly disposed at the Former Pesticide Pile Area on the Robinson property and at the Suspected Pesticide Landfarm, presently located on property owned by Willard Lloyd. Both disposal activities allegedly took place sometime prior to the spring of 1981 and allegedly may have involved pesticides and other debris from a 1975 fire at the Miller Chemical Company in Ranson, West Virginia, approximately five miles southeast of the Bell Spring Run watershed.

Local accounts of the disposal activities agree only in that Mr. Arthur Dodson, Sr., was the principal. At the time of the alleged incident, Mr. Dodson was operated a dairy farm in the area, as noted above. One account indicates that spreadable debris from the Miller Chemical fire were landfarmed in 1975 on a tract of approximately 100 acres (Hughart 1981). This tract was being leased at the time of the disposal by Mr. Dodson from Mr. Jeffrey Sagel, and is now owned by Mr. Willard Lloyd. This account further indicates that debris which could not be spread were dumped on the Robinson property , also being leased at the time by Mr. Dodson.

A second account suggests that the pesticide pile on the Robinson property, while originating from the Miller Chemical facility, consisted only of lime slag and fine material cleaned from the facility during normal housekeeping operations, and had little to do with the fire (Northeimer, 1982). The second account does not refer to any landfarming of pesticides on the Lloyd property.

Irrespective of the means by which the pesticide pile was placed on the Robinson property, initial concern was raised by representatives of the Leetown NFC, based on analyses of the pile done in 1981. These analyses showed elevated levels of pesticides. During a subsequent site inspection by the West Virginia Department of Natural Resources (WVDNR) on August 26, 1981, it was determined that an area of about 1,000 square feet had been covered to a depth of about 4 feet with a crystalline material. Samples of the material and its immediate surroundings taken by the WVDNR on October 27, 1981, showed elevated levels of alpha-BHC pesticides (186,000 parts per billion (ppb)) as well as DDT (37,000 ppb) and DDE (63,300 ppb).

In 1982 the Miller Chemical Company agreed to cooperate in removing the pile, but continued to maintain that the pile did not contain pesticides from the fire at its facility. Between April and June 1983 the Miller Chemical Company removed about 160 cubic yards of waste and soil material from the pile area.

Two ongoing landfills represent the only significant, known activity of this type with the watershed. Historically, the first of these landfills occupies land presently owned by the West Virginia Department of Highways (WVDOH), and is located immediately north of their maintenance facility at the intersection of Routes 6 (Darke Lane), 15, and 15/1. The solid waste landfill, as well as an associated road kill disposal area and limestone quarry, are operated solely for the use of the WVDOH, and are presently secured from unauthorized vehicle access by a chain link fence. According to a local resident, however, this landfill operated prior to development of the Jefferson County Landfill, discussed below, as a refuse disposal area for local residents. In particular, aerosol cannisters of DDT produced by the Dixie-Narco Company in Charles Town were disposed of in the landfill. These cannisters are known locally as DDT bombs, and were used for topical application of DDT to cattle to control flies. Typical waste handling practices at the landfill at the time of DDT bomb disposal included burning the refuse. A number of the cannisters allegedly exploded during this process.

The Jefferson County Landfill is located immediately east of the WVDOH maintenance garage, across Route 15/1. This municipal and industrial waste disposal facility has been active since 1967, with the Jefferson County Commission assuming responsibility for its operation in 1972.

In 1981 the State Department of Health gave permission for the 3-M plant in Middleway, West Virginia, to place one truckload (approximately 5 cubic yards) of sludge in the landfill daily. However, this approval was rescinded when approximately 600 cubic yards of the sludge was deposited in the landfill during the first two days of the project.

The Jefferson County Landfill has been listed in West Virginia's Open Dump Inventory as a potential candidate for further investigation relative to listing on the National Priorities List. The first step in this process, development of a Preliminary Assessment (PA), was undertaken by the WVDNR, Division of Water Resources, on April 4, 1984. It is anticipated that this process will continue, with ultimate ranking of the Jefferson County Landfill using the Hazard Ranking System (HRS), and evaluation of the possibility of inclusion of the site on the NPL. Since this was known to be the case, the actual investigation of the landfill focused on the potential offsite migration of contaminants throught the groundwater and surface water systems, rather than on characterization of the landfill itself. The primary purpose of this was to determine the overall quality of the drinking water source (aquifer) in the Leetown Area, and, if any contamination was found, to pinpoint sources of that contamination to mitigate the problem.

Similarly, the WVDOH landfill is part of an active facility and the responsibility for maintenance and safe operation of the landfill rests with the WVDNR. The RI attempted to define the potential for contaminant migration from this landfill via direct contact with landfill soils, but did not attempt to fully characterize the contents of the landfill.

C. Remedial Investigation Scope

A total of 443 environmental samples were collected in various matrix at different locations during the Leetown Pesticide Superfund Project. Table 1 provides a breakdown of the number of samples and matrix for each sampling area.

D. Hydrologic Investigation (Surface Waters)

D-1. Physical Data:

Local streams and their topographic drainage divides relevant to the Leetown Pesticide Site are shown in Figure 4. The surface water drainage system is predominantly of the trellis type in which streams of similar order run parallel to each other and lie perpendicular to their tributaries and receiving streams. In the Leetown area however, much drainage apparently occurs through solution channels in the underlying limestone bedrock. This is evidenced by the fact that most first order streams originate at free-flowing springs situated in highly-folded and faulted carbonate rocks. Large portions of individual topographic drainage basins above these springs are without defined stream channels, indicating the presence of solution cavities which collect and transmit infiltrated rainfall.

Local streams most likely to receive contaminants directly from sources in the study area include Link Spring Run, Bell Spring Run, and Gray Spring Run. Both Link and Bell Spring Runs originate at springs located approximately 3/4 of a mile east of the Leetown National Fisheries Center (NFC). Both streams flow westward past, and in some cases directly adjacent to, contaminated areas. Link Spring Run forms a confluence with Bell Spring about 1/2 mile east of the NFC, just south of the former Crimm Orchard. Bell Spring Run continues westward through a manmade impoundment of the NFC (Reservoir A) past Leetown Road and into Hopewell Run near the Handicapped Fishing Area.

Gray Spring Run actually originates at two springs (Blue and Gray) located on NFC propertty approximately 2000 feet southeast of the administration building. Gray Spring Run flows through a less developed area of the NFC, past homes on Leetown Road and into Hopewell Run 1000 feet south of Bell Spring Run. Bell Spring Run receives surface water runoff from the contaminated areas, as well as runoff from the Jefferson and Crimm Orchards. Surface water and sediment, were obtained from Bell Spring to assess the impacts of the contaminated areas (including the orchards) on this surface water body and its aquatic life.

6-a

Table 1

Scope of Sampling During the Leetown Pesticide Remedial Investigation

Sampling Location	Matrix	Number of Samples
Background (Non-Pesticide Areas)	Surface Soil	35
Crimm Orchard (Tabb Property)	Surface Soil	4
Crimm Orchard Packing Shed (Tabb Barn)	Surface Soil	10
Jefferson Orchard (U.S. FTW Property)		10
Jefferson Orchard (Robinson Property)	Surface Soil	3
	Ground Water	6
Jefferson Orchard Pesticide Mixing Area (Robinson Property)	Surface Soil	16
Pesticide Pile Area (Robinson Property)	Surface Soil	40
	Ground Water	4
WV-DOH Garage Landfill	Surface Soil	7
	Ground Water	2
Suspected Pesticide Landfarm (Lloyd Property)	Surface Soil	146
	Ground Water	6
Jefferson Co. Landfill	Ground Water	13
National Fisheries Center/ Hopewell Run Watershed	Surface Water	13
	Sediment	49
	Fish	15
Residential Wells	Ground Water	13
Springs	Ground Water	8
Link Spring and Bell Spring Runs	Surface Water	19
	Sediment	16
	Fish	8

Totals

Matrix	# of Samples
Surface Soils	271
Ground Water	52
Surface Water	32
Sediment	65
Fish	23
Total	443

6-b

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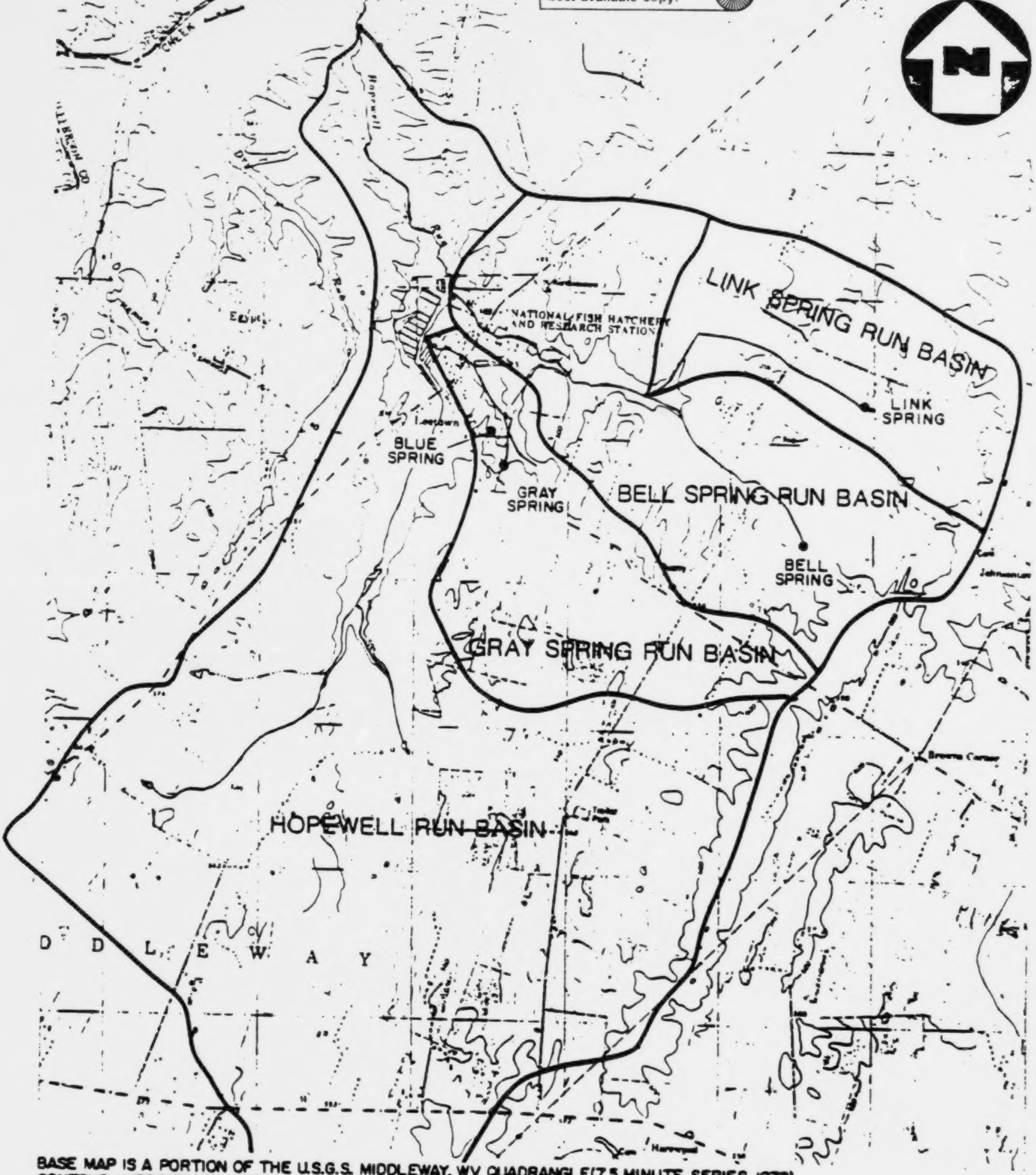
N
LINK SPRING RUN BASIN
LINK SPRING
NATIONAL FISH HATCHERY AND RESEARCH STATION
Hopewell
Leetown
BLUE SPRING
GRAY SPRING
BELL SPRING RUN BASIN
BELL SPRING
GRAY SPRING RUN BASIN
HOPEWELL RUN BASIN
D D L E W A Y

BASE MAP IS A PORTION OF THE U.S.G.S. MIDDLEWAY, WV QUADRANGLE(7.5 MINUTE SERIES 1978)
CONTOUR INTERVAL 20 FEET.

TOPOGRAPHIC DRAINAGE BASINS
FOR STUDY AREA STREAMS
LEETOWN PESTICIDE SITE, LEETOWN, WV

Figure 4

SCALE: 1" = 3000'

D-2. Chemical Data: Sampling locations for the Bell Spring Run watershed are indicated in Figure 5.

The analytical results indicate that surface water samples from Bell Spring Run do not contain organic chemicals found in soil samples from the contaminated areas. The only Hazardous Substance List (HSL) organic chemical detected in surface water samples were di-n-butyl phthalate, pyrene, and acenaphthene. These analytes were identified sporadically (less than 2 of 14 samples) and at low concentrations. Pyrene (4 ug/l) and acenaphthene (6 ug/l) were detected in samples obtained at downstream loctions, either near the wetland area or immediately upelevation of it. These substances may be present because of isolated, small spills in the area. These analytes were identified in only one of two duplicate samples from the wetland area. Polynuclear aromatics (PAHs) were not identified in the three primary source areas and were not detected at appreciable concentrations in any of the other areas investigated. The presence of these substances is not considered indicative of a PAH problem at the Leetown Pesticide Site. Di-n-butyl phthalate was detected in one sample at a concentration of 4 ug/l. This, and other phthalate esters are common laboratory contaminants. The sporadic occurrence of this substance and the low concentration detected do not indicate that this substance ot other phthalate esters are present in Bell Spring Run at levels of concern.

The results for inorganic analytes for surface water samples indicate that arsenic, copper, chromium, lead, mercury, and zinc are present in Bell Spring Run. All but the arsenic concentration exceed the Ambient Water Quality Criteria for the protection of aquatic life. Since inorganic concentrations in surface water samples do not vary significantly from the upstream to the downstream locations, these concentrations may be representative of natural background levels. A summary assessment of the impacts of these substances on aquatic organisms is provided in this documents Health and Environmental Impacts Section, (Section K).

E. Hydrologic Investigation (Sediments)

Table 2 presents HSL pesticide and inorganic analytical results for sediment samples collected from Bell Spring Run and Link Spring Run during the RI. Various HSL organic chemicals were detected in sediment samples obtained from Bell Spring Run. Phenol and 4-methylphenol were detected in three of twelve sediment samples collected from the stream and the downstream wetland area. Benzoic acid was detected in two sediment samples obtained from Bell Spring Run.

Of the eight areas studies during the Remedial Investigation, only the Jefferson County Landfill constitutes a potential source of these chemcials. Phenol and benzoic acid were detected in landfill monitoring well samples at maximum concentrations of 9 ug/l and 11 ug/l respectively. The low concentrations of these analytes detected in monitoring well samples and various aspects of the sediment results themselves tend to rule out the landfill as the source of these chemicals.

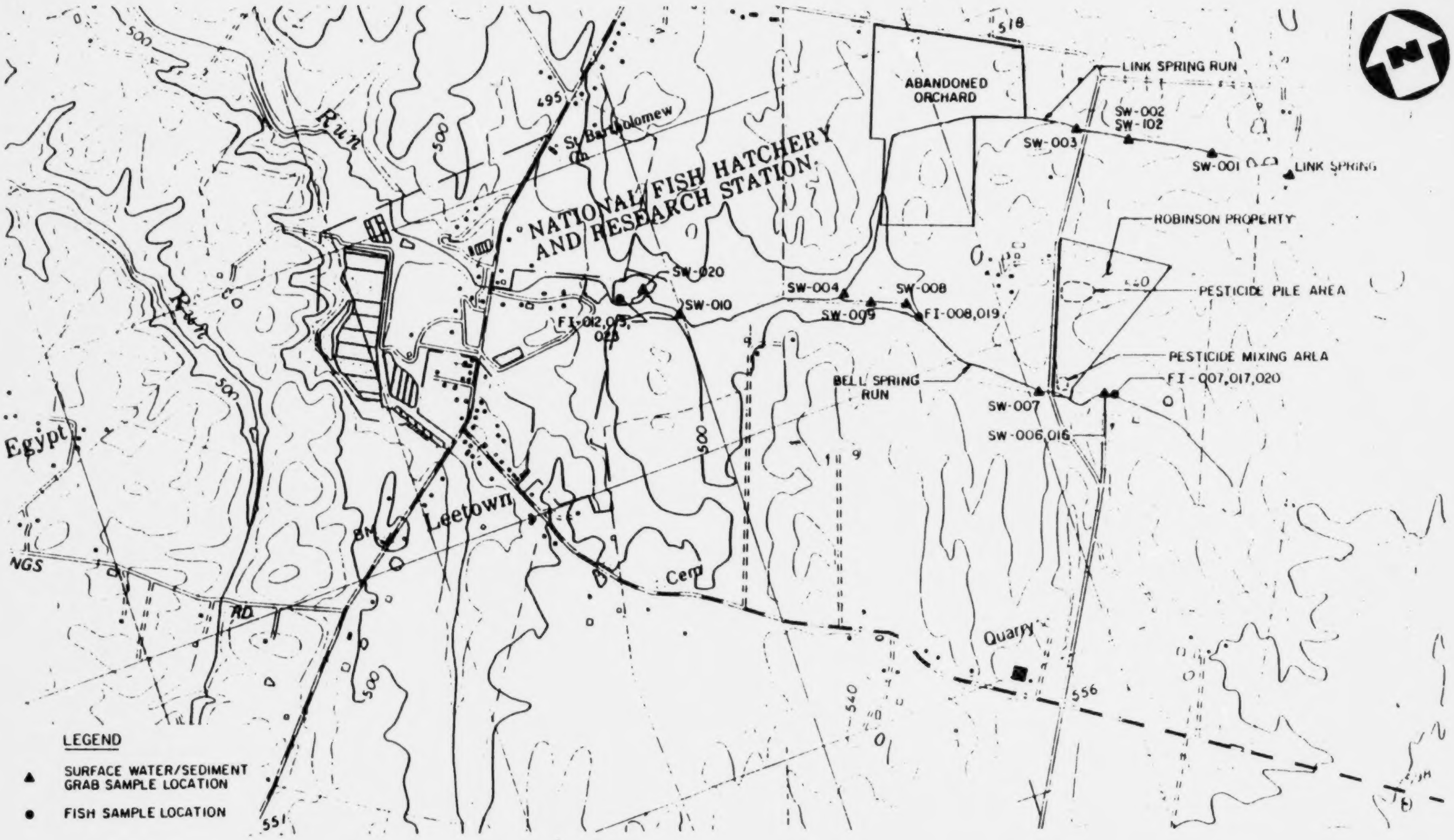
LINK SPRING RUN
ABANDONED ORCHARD
518
SW-002
SW-102
SW-003
SW-001
LINK SPRING
ROBINSON PROPERTY
PESTICIDE PILE AREA
PESTICIDE MIXING AREA
FI-007,017,020
SW-007
SW-006,016
BELL SPRING RUN
SW-004
SW-009
SW-008
FI-008,019
SW-020
SW-010
FI-012,013,
023
NATIONAL FISH HATCHERY AND RESEARCH STATION
St Bartholomew
Ch
495
Run
Run
500
500
Egypt
Leetown
BM
NGS
RD
Cem
Quarry
540
556
551
LEGEND
▲ SURFACE WATER/SEDIMENT GRAB SAMPLE LOCATION
● FISH SAMPLE LOCATION
0
1000
2000
SCALE IN FEET

Figure 5

SURFACE WATER, SEDIMENT & FISH SAMPLING LOCATIONS
BELL/LINK SPRING WATERSHEDS
LEETOWN PESTICIDE SITE, LEETOWN, WV

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Table 2

Sediment Analytical Results
Link and Bell Spring Runs
and Marsh Area at Leetown

Location	Chemical	Concentration Range	Detection Frequency
Bell Spring Run	4,4'-DDT	10-12 ug/kg	2/8
	4,4'-DDD	8.8-37 ug/kg	2/8
	4,4 -DDE	4.0-140 ug/kg	7/8
	Arsenic	ND	0/8
	Lead	6.1-35 mg/kg	8/8
Link Spring Run	4'4'-DDT	ND	0/4
	4'4'-DDD	4.0 ug/kg	1/4
	4,4 -DDE	4.1-8.3 ug/kg	2/4
	Arsenic	12 mg/kg	1/4
	Lead	7-28 mg/kg	4/4
Marsh Area	4'4 -DDT	ND	0/4
	4'4 -DDD	24 ug/kg	1/4
	4'4 -DDE	100 ug/kg	1/4
	Arsenic	ND	0/4
	Lead	11-27 mg/kg	4/4

Although phenol and benzoic acid were detected in one sediment sample at relatively high concentrations (830 and 1,600 ug/kg, respectively), they were not detected in a duplicate sample obtained at the same location. This discrepancy indicates that either the contamination with these chemicals is not extensive (i.e., it is very localized), or that these substances may have been inadvertently introduced to the samples during extraction and preparation. The fact that these chemicals were identified only in the one sample and at a substantial distance downstream in the wetland area, is considered further evidence of only isolated contamination with these substances.

The appearance of these chemicals in sediment samples is considered highly unusual, especially in light of their absence in surface water samples obtained at the same locations.

Pesticide compounds, including 4,4'-DDT and metabolites, were identified in numerous sediment samples obtained from Bell Spring Run. The presence of pesticides in sediments is probably directly attributable to surface water convection of contaminated soil from both the primary contamination zones and the former apple orchards. Sediments obtained adjacent to the Robinson property pesticide mixing area contained the highest levels of 4,4'-DDT and metabolites. This is considered evidence of the impact of the residual contamination remaining in this area. Another area with relatively high concentrations of pesticides (124 ug/kg total DDT and metabolites) is the wetland area at the western end of Bell Spring Run. This is an area where suspended sediments are expected to settle; thus the presence of pesticides in this area is not unusual.

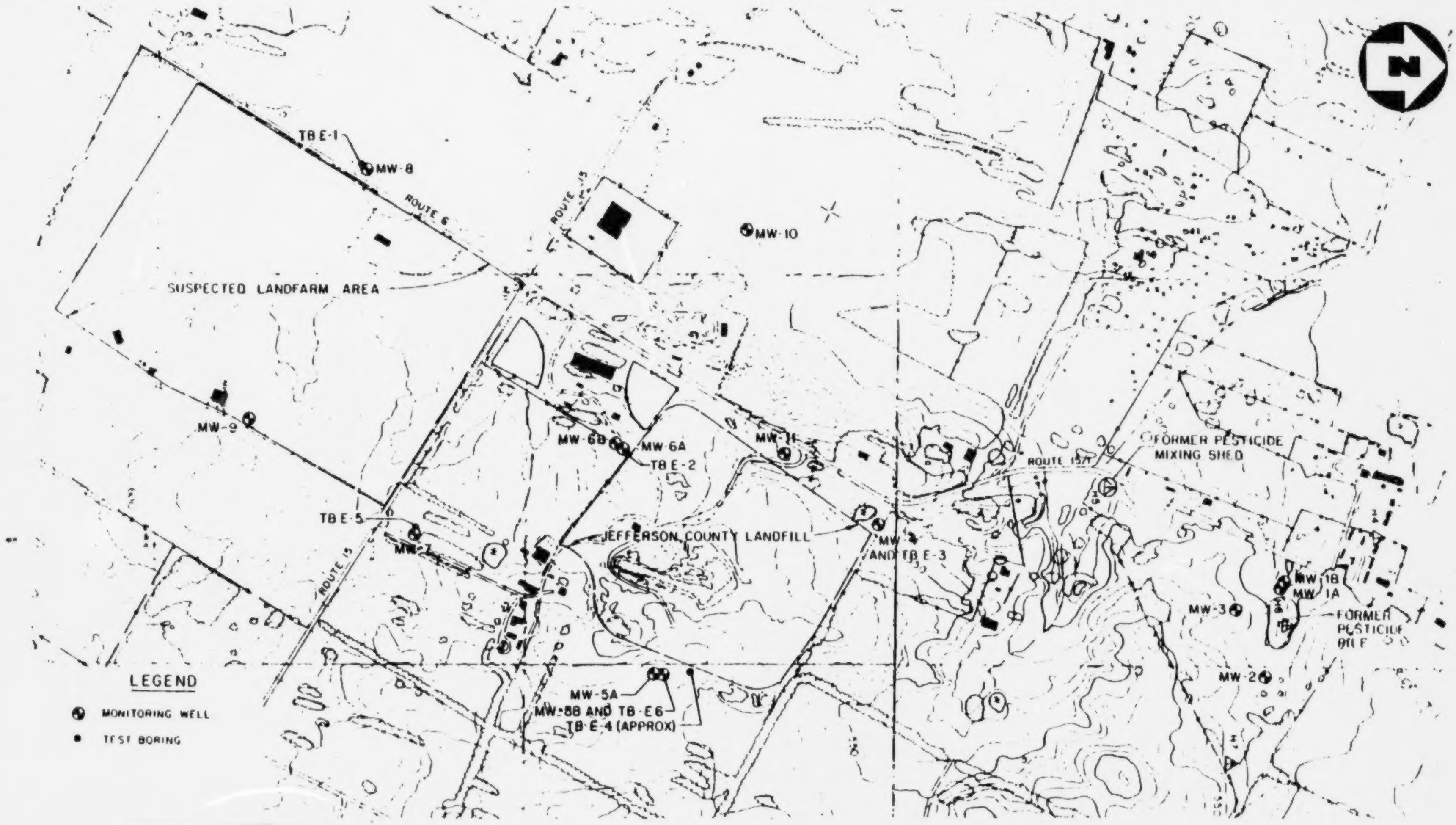
The results for inorganic analytes presented in Table 2 indicate that inorganic concentrations are similar in sediment samples collected along the length of Bell Spring Run.

F. Hydrogeologic Investigation (Geology)

The initial phase of the subsurface investigation concentrated on the suspected source areas of contamination as opposed to a comprehensive hydrogeologic investigation and monitoring network. A survey of the nearby domestic water wells through discussions with local residents revealed that the majority of wells are deeper than 150 feet. In some cases wells were drilled to this depth to increase yield for trailer courts and farms, and in other cases permeability was low in the upper part of the aquifer and drilling was advanced to intercept deeper, water-bearing fractures. Additionally, some of these deeper wells are cased off through the upper part of the water table due to turbidity caused by clay-filled cavities.

Since many of the domestic wells sampled are at least 150 feet deep and showed no evidence of contamination in previous sampling done by the Jefferson County Health Department (JCHD) and in the RI, the first phase of the drilling program was designed to monitor groundwater quality in the shallow part of the aquifer close to the suspected source areas where dilution and dispersion would be minimized.

8-a


N
TB E-1
MW-8
ROUTE 6
ROUTE 15
MW-10
SUSPECTED LANDFARM AREA
MW-9
MW-6B
MW-6A
TB E-2
MW-11
FORMER PESTICIDE MIXING SHED
ROUTE 15?
TB E-5
MW-7
JEFFERSON COUNTY LANDFILL
MW-4 AND TB E-3
MW-1B
MW-1A
MW-3
FORMER PESTICIDE PILE
MW-2
ROUTE 15
MW-5A
MW-5B AND TB-E6
TB-E-4 (APPROX)
LEGEND
MONITORING WELL
TEST BORING
0
500
1000
SCALE IN FEET

Reproduced from
best available copy.

SUBSURFACE INVESTIGATION BASE MAP
LEETOWN PESTICIDE SITE, LEETOWN, WV

Figure 6

During the first phase, 6 exploration borings were drilled and 14 monitoring wells were installed. Four wells were installed at the former pesticide pile area, 6 wells and 4 exploration borings around the periphery of the Jefferson County Landfill and 4 wells and 2 exploration borings on or within close prioximity to the suspected pesticide landfarm area. In addition 13 residential wells in the Leetown Area were sampled and analyzed for HSL Organics and Inorganics. Figure 6 is a well and exploratory boring location map for the work undertaken in the remedial investigation. To define flow directions and aquifer parameters, permeability testing and dye tracer testing were conducted after monitoring well installation.

Borehole logging was conducted on 5 of the 6 exploration boreholes (E-1, E-2, E-3, E-5 and E-6) and on monitoring wells MW-1B, MW-3, MW-5B, MW-7, MW-8 and MW-11. Extremely useful information was obtained on water-bearing fracture systems, solutions channeling, and degree and extent of fracturing in bedrock.

Logs utilized in the investigation were spontaneous potential, temperature, fluid conductivity, resistivity, sonic, gamma, density, caliper and neutron.

Three different methods of permeability testing were used to determine aquifer parameters: packer testing, constant head infiltration, and slug testing.

F-1. Physical Data:

The Leetown Site is underlain by a sequence of steeply-dipping, faulted carbonate rocks, and varying thicknesses of residual soils. The site area is characterized by a very high degree of lateral variability in occurrence of geologic formations due to the extensive folding. In addition to this, the presence of a karst terrain with solutioning activity in the carbonate bedrock contributes to complicate the hydrogeologic setting.

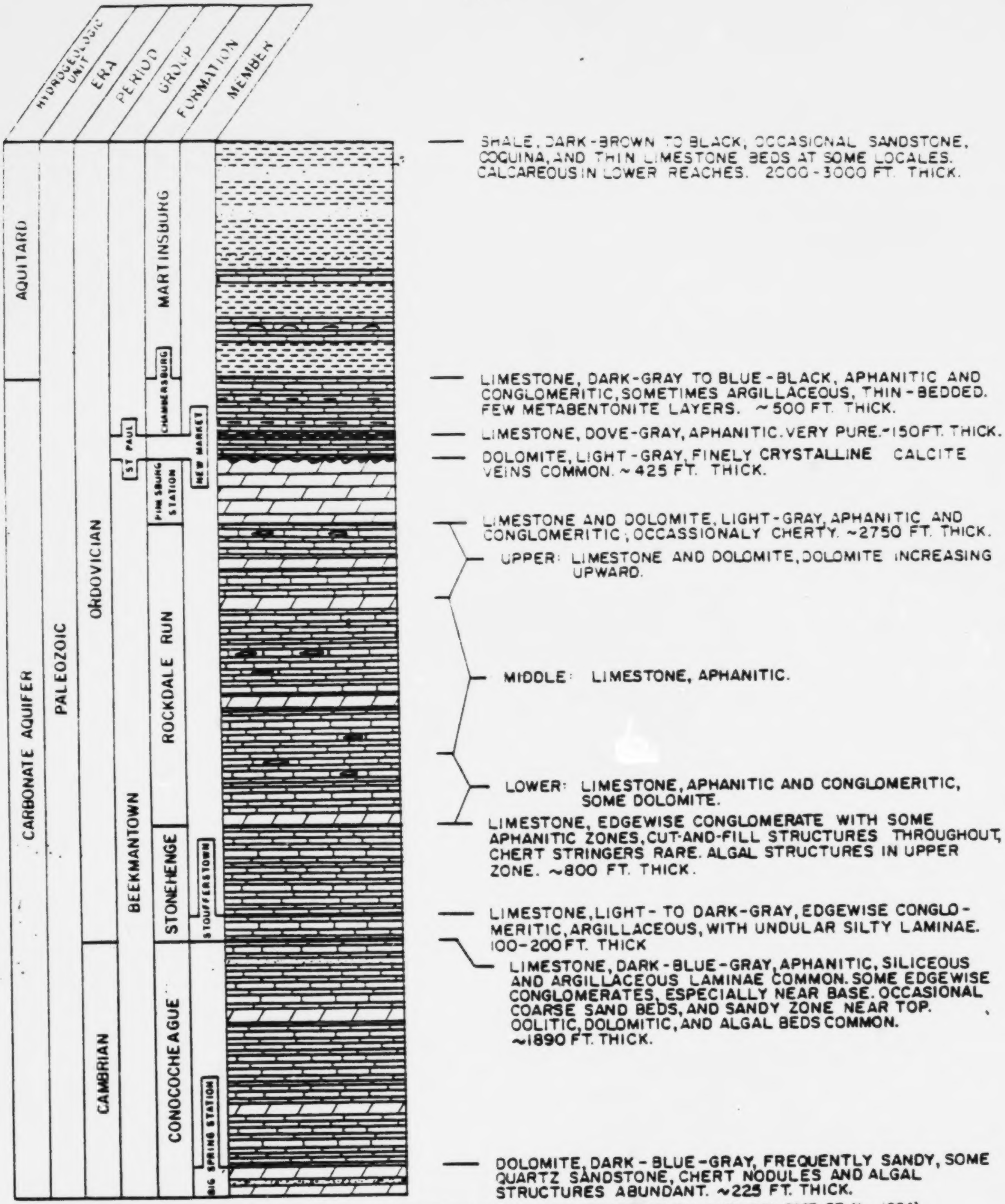
A generalized strategic column is illustrated in Figure 7. A geologic map of the Leetown area is found in Figure 8 and a geologic cross section within the easternmost conococheague formation is presented in Figure 9. In addition, a generalized geologic cross-section of the former pesticide pile area is found in Figure 10.

G. Hydrogeologic Investigation (Ground Water)

G-1. Physical Data:

The water table aquifer within the area of investigation is a very complex hydrogeologic system with many factors controlling ground water flow. The folded and faulted Ordovician to Cambrian carbonate deposits which make up the aquifer have virtually no primary porosity. Secondary porosity, consisting of fractures, bedding planes, joints and cleavage planes are the pathways for ground water flowing through bedrock. Many of these secondary openings have been widened by solution activity within the carbonate deposits. Conversely, calcite veins and fillings have

-9-a


HYDROGEOLOGIC UNIT
ERA
PERIOD
GROUP
FORMATION
MEMBER
AQUITARD
CARBONATE AQUIFER
PALEOZOIC
ORDOVICIAN
CAMBRIAN
ST PAUL
BEEKMANTOWN
MARTINSBURG
CHAMBERSBURG
PINESBURG STATION
ROCKDALE RUN
STONEHENGE
CONOCOCHEAGUE
NEW MARKET
STOUFFERSTOWN
BIG SPRING STATION

SHALE, DARK-BROWN TO BLACK, OCCASIONAL SANDSTONE, COQUINA, AND THIN LIMESTONE BEDS AT SOME LOCALES. CALCAREOUS IN LOWER REACHES. 2000-3000 FT. THICK.

LIMESTONE, DARK-GRAY TO BLUE-BLACK, APHANITIC AND CONGLOMERITIC, SOMETIMES ARGILLACEOUS, THIN-BEDDED. FEW METABENTONITE LAYERS. ~500 FT. THICK.

LIMESTONE, DOVE-GRAY, APHANITIC. VERY PURE. ~150 FT. THICK.

DOLOMITE, LIGHT-GRAY, FINELY CRYSTALLINE CALCITE VEINS COMMON. ~425 FT. THICK.

LIMESTONE AND DOLOMITE, LIGHT-GRAY, APHANITIC AND CONGLOMERITIC, OCCASSIONALY CHERTY. ~2750 FT. THICK.

UPPER: LIMESTONE AND DOLOMITE, DOLOMITE INCREASING UPWARD.

MIDDLE: LIMESTONE, APHANITIC.

LOWER: LIMESTONE, APHANITIC AND CONGLOMERITIC, SOME DOLOMITE.

LIMESTONE, EDGEWISE CONGLOMERATE WITH SOME APHANITIC ZONES, CUT-AND-FILL STRUCTURES THROUGHOUT, CHERT STRINGERS RARE. ALGAL STRUCTURES IN UPPER ZONE. ~800 FT. THICK.

LIMESTONE, LIGHT- TO DARK-GRAY, EDGEWISE CONGLOMERITIC, ARGILLACEOUS, WITH UNDULAR SILTY LAMINAE. 100-200 FT. THICK

LIMESTONE, DARK-BLUE-GRAY, APHANITIC, SILICEOUS AND ARGILLACEOUS LAMINAE COMMON. SOME EDGEWISE CONGLOMERATES, ESPECIALLY NEAR BASE. OCCASIONAL COARSE SAND BEDS, AND SANDY ZONE NEAR TOP. OOLITIC, DOLOMITIC, AND ALGAL BEDS COMMON. ~1890 FT. THICK.

DOLOMITE, DARK-BLUE-GRAY, FREQUENTLY SANDY, SOME QUARTZ SANDSTONE, CHERT NODULES AND ALGAL STRUCTURES ABUNDANT. ~225 FT. THICK.

(SOURCES: GRINSKY, 1916; WOODWARD, 1949; WOODWARD, 1951; HOBBA, ET., AL., 1973; ENVIRONMENTAL DATA, 1981; PAGE, ET. AL., 1964).

GENERALIZED STRATIGRAPHIC COLUMN
LEETOWN PESTICIDE SITE, LEETOWN, WV

Figure 7

9-b

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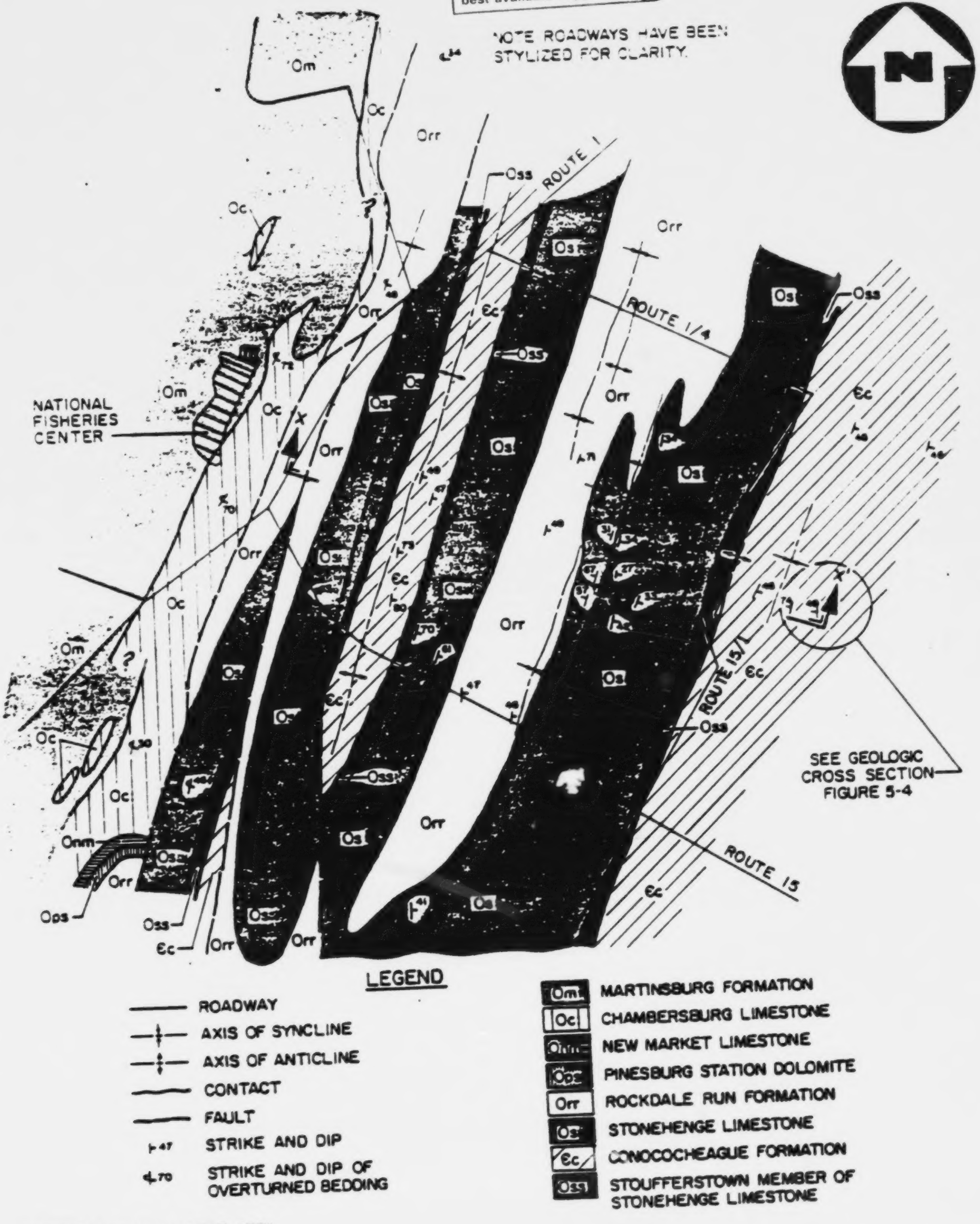
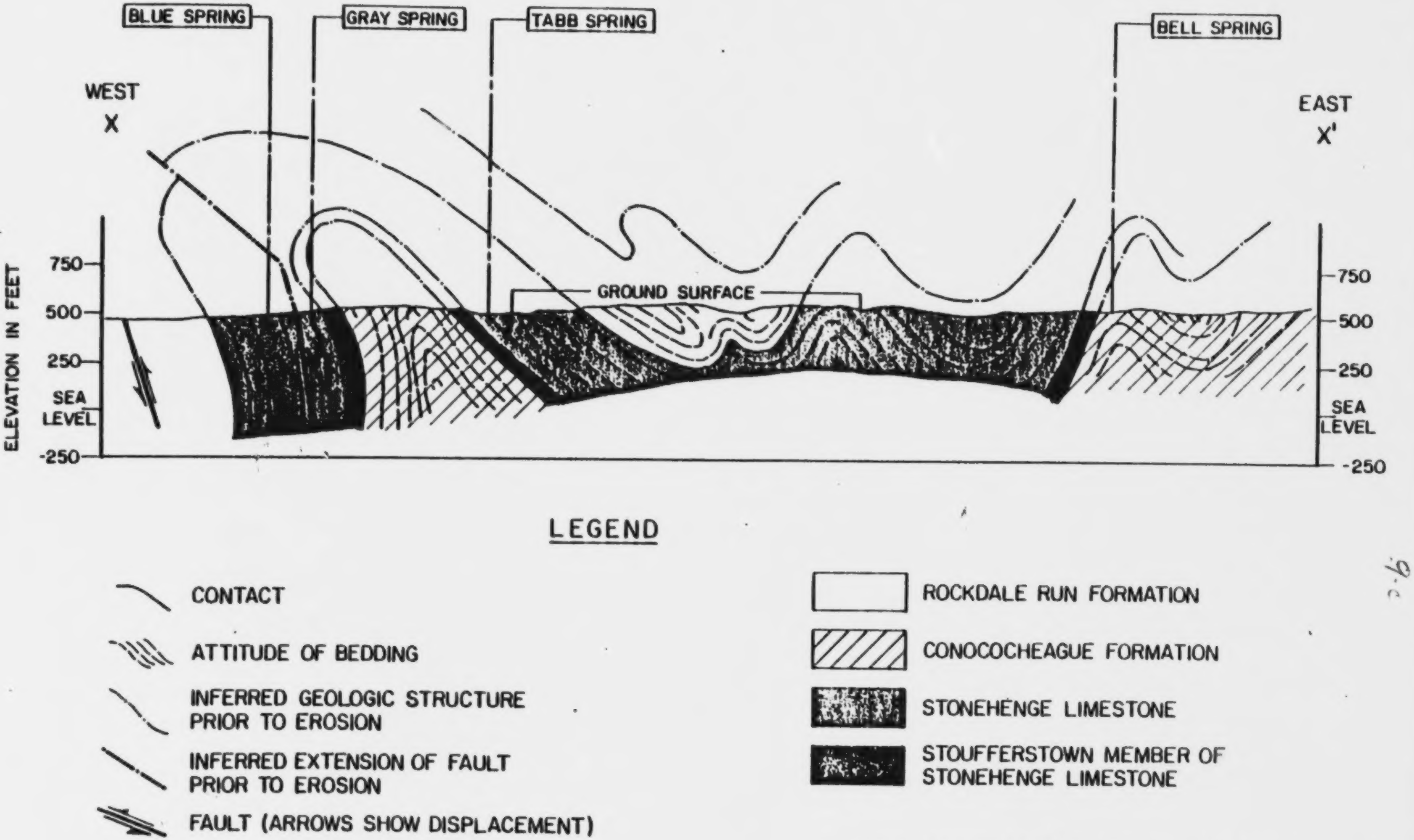

NOTE ROADWAYS HAVE BEEN STYLIZED FOR CLARITY.
N
Om
Oc
Orr
ROUTE 1
Oss
Os
ROUTE 1/4
Ꞓc
NATIONAL FISHERIES CENTER
X
X'
ROUTE 15/1
ROUTE 15
SEE GEOLOGIC CROSS SECTION FIGURE 5-4
Onm
Ops
?
LEGEND
ROADWAY
AXIS OF SYNCLINE
AXIS OF ANTICLINE
CONTACT
FAULT
47 STRIKE AND DIP
70 STRIKE AND DIP OF OVERTURNED BEDDING
Om MARTINSBURG FORMATION
Oc CHAMBERSBURG LIMESTONE
Onm NEW MARKET LIMESTONE
Ops PINESBURG STATION DOLOMITE
Orr ROCKDALE RUN FORMATION
Os STONEHENGE LIMESTONE
Ꞓc CONOCOCHEAGUE FORMATION
Oss STOUFFERSTOWN MEMBER OF STONEHENGE LIMESTONE

SOURCE: JONES & DIEKE, 1981

Figure 8

GEOLOGIC MAP OF THE LEETOWN AREA
LEETOWN PESTICIDE SITE, LEETOWN, WV
SCALE: 1" = 2000'

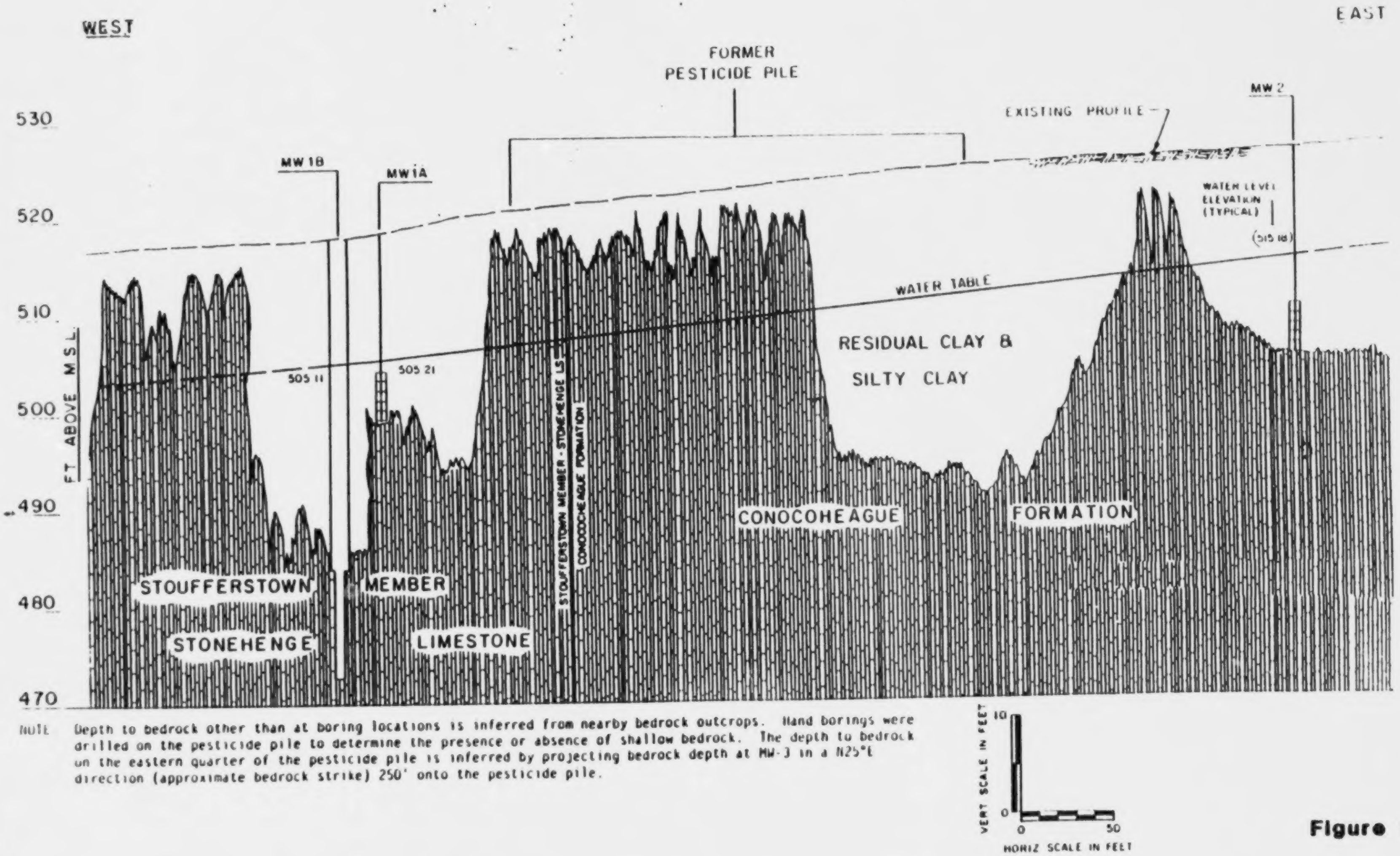
9-c


BLUE SPRING
GRAY SPRING
TABB SPRING
BELL SPRING
WEST
X
EAST
X'
GROUND SURFACE
ELEVATION IN FEET
750
500
250
SEA LEVEL
-250
LEGEND
CONTACT
ATTITUDE OF BEDDING
INFERRED GEOLOGIC STRUCTURE PRIOR TO EROSION
INFERRED EXTENSION OF FAULT PRIOR TO EROSION
FAULT (ARROWS SHOW DISPLACEMENT)
ROCKDALE RUN FORMATION
CONOCOCHEAGUE FORMATION
STONEHENGE LIMESTONE
STOUFFERSTOWN MEMBER OF STONEHENGE LIMESTONE

NOTE: FOR LOCATION OF CROSS SECTION SEE FIGURE 5-3

Figure 9

GEOLOGIC CROSS SECTION
LEETOWN PESTICIDE SITE, LEETOWN, WV
SCALE: 1" = 1000' HORIZ., 1" = 100' VERT. (VERT. EXAGGERATION 10x)


WEST
EAST
FORMER
PESTICIDE PILE
EXISTING PROFILE
MW 1B
MW 1A
MW 2
WATER LEVEL
ELEVATION
(TYPICAL)
(515.18)
505.11
505.21
WATER TABLE
RESIDUAL CLAY &
SILTY CLAY
FT ABOVE MSL
530
520
510
500
490
480
470
STOUFFERSTOWN
STONEHENGE
MEMBER
LIMESTONE
STOUFFERSTOWN MEMBER - STONEHENGE LS
CONOCOCHEAGUE FORMATION
CONOCOHEAGUE
FORMATION
VERT SCALE IN FEET
10
0
HORIZ SCALE IN FEET
0
50

NOTE Depth to bedrock other than at boring locations is inferred from nearby bedrock outcrops. Hand borings were drilled on the pesticide pile to determine the presence or absence of shallow bedrock. The depth to bedrock on the eastern quarter of the pesticide pile is inferred by projecting bedrock depth at MW-3 in a N25°E direction (approximate bedrock strike) 250' onto the pesticide pile.

Figure 10

GENERALIZED GEOLOGIC CROSS SECTION-PESTICIDE PILE AREA
LEETOWN PESTICIDE SITE, LEETOWN, WV

sealed some of these openings. The aquifer, for the most part, occurs under water table conditions; however, local departures from the water table conditions are prevalent at some of the well locations.

Figure 11 is a water table contour map of the area of investigation under typical water table conditions showing an overall west, northwest ground water flow direction. This map compares favorably with a water table contour map of the overall Leetown area prepared by Environmental Data in 1981 (Jones and Dieke, 1981). Figure 12 is a cross-section parallel to the water table contours.

Although the contour map is indicative of the overall ground water flow direction, it masks the localized control that bedding planes, joints, fractures, and thick residual clay deposits exert on ground water flow in this karst environment.

The strike of the beds near the potential contaminant source areas is approximately N20°E. In this area, bedrock is steeply dipping, creating a potential groundwater flow component along both bedding planes and the strike of bedrock outcrops. This would cause groundwater flow in an approximate north-northeast and/or south-southwest direction which is approximately parallel to the water table contours.

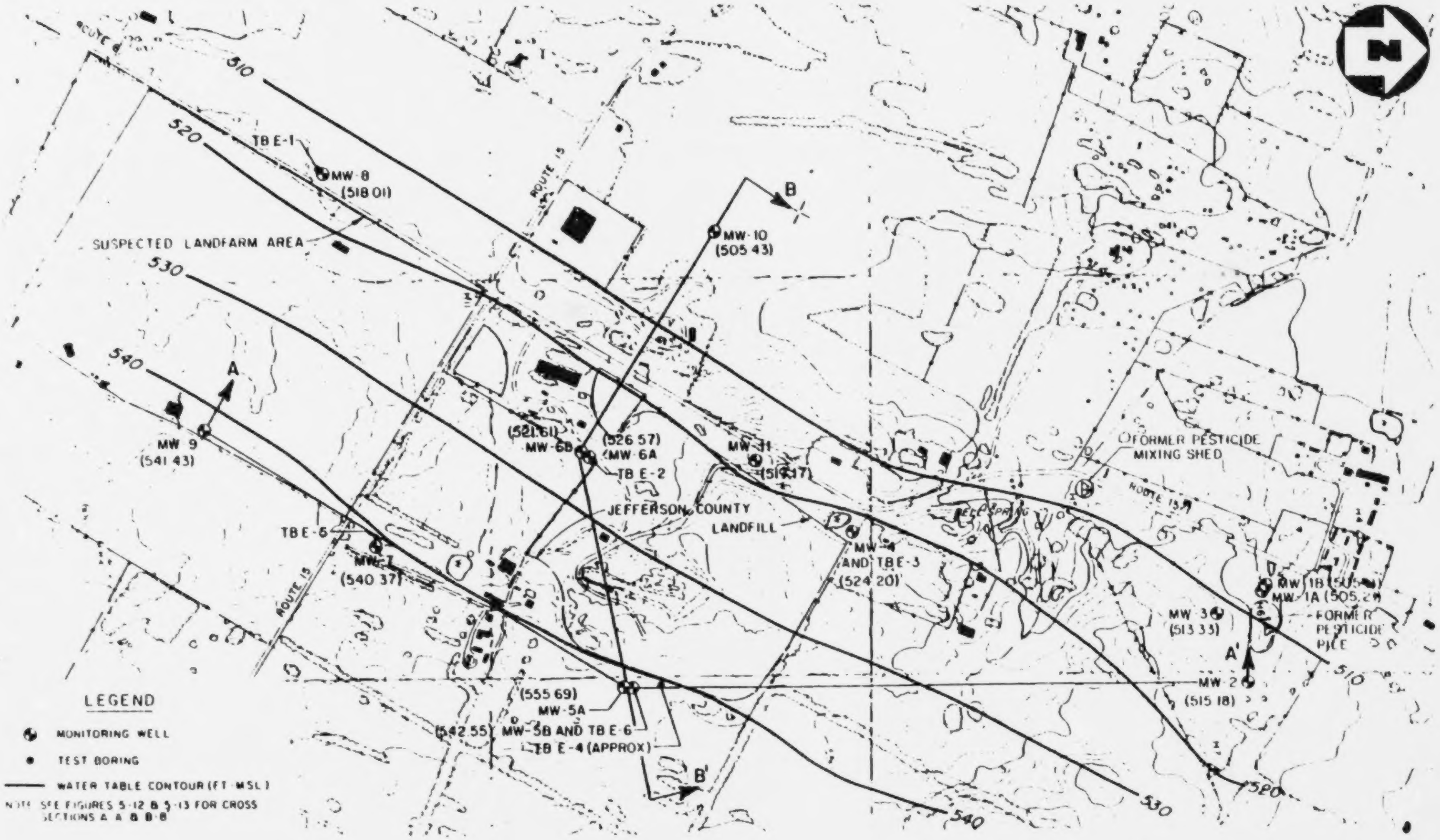
Borehole geophysical logging of the exploration borings and monitoring wells illustrates the secondary porosity characteristic of this carbonate aquifer. Water-bearing fractures and solution weathered zones are readily identifiable on the logs of borings with moderate to good permeability. Borings with low permeability were difficult to correlate hydrologically, and generally did not show conclusive results from the geophysical logs.

Recharge to the aquifer is the result of precipitation and infiltration. Response of the aquifer to precipitation events is variable in rate and magnitude and is dependent on the interconnection of the ground surface to the aquifer and the localized storage capacity of the aquifer.

Dye-tracer testing of the aquifer confirms the localized, multi-directional flow within the system. Significant precipitation events were found to increase the flow velocity drastically within the groundwater system and flush groundwater from temporary storage.

Ground water flow direction and velocity are highly controlled by seasonal influences, only a portion of which were actually reflected in the dye-tracer study performed as a part of the RI. Based on the observation of dyes in Gray Spring, velocity of groundwater flow appears to be in excess of 100 feet per day (ft/day). This flow velocity apparently resulted from a sudden inflow of water to the system as a result of dramatic increases in infiltration. Under low water table conditions, however, groundwater flow rates are not driven by inflow, and appear to be extremely low.

The storage capacity of the aquifer appears rather large, based on the concentrations of tracers remaining in the injection wells after 5 months.


N
310
520
530
540
510
ROUTE 9
ROUTE 15
ROUTE 15
ROUTE 15
TB E-1
MW-8
(518 01)
SUSPECTED LANDFARM AREA
MW-10
(505 43)
B
B'
A
A'
MW 9
(541 43)
TB E-5
MW-7
(540 37)
(521.61)
MW-6B
(526 57)
MW-6A
TB E-2
MW-11
JEFFERSON COUNTY
LANDFILL
MW-4
AND TB E-3
(524 20)
FORMER PESTICIDE
MIXING SHED
MW-1B
MW-1A (505.2
FORMER
PESTICIDE
PILE
MW-3
(513 33)
MW-2
(515 18)
(555 69)
MW-5A
(542.55) MW-5B AND TB E-6
TB E-4 (APPROX)
LEGEND
MONITORING WELL
TEST BORING
WATER TABLE CONTOUR (FT-MSL)
NOTE SEE FIGURES 5-12 & 5-13 FOR CROSS SECTIONS A-A' & B-B'
0
500
1000
SCALE IN FEET

WATER TABLE CONTOUR MAP 3/ 6/85
LEETOWN PESTICIDE SITE, LEETOWN, WV

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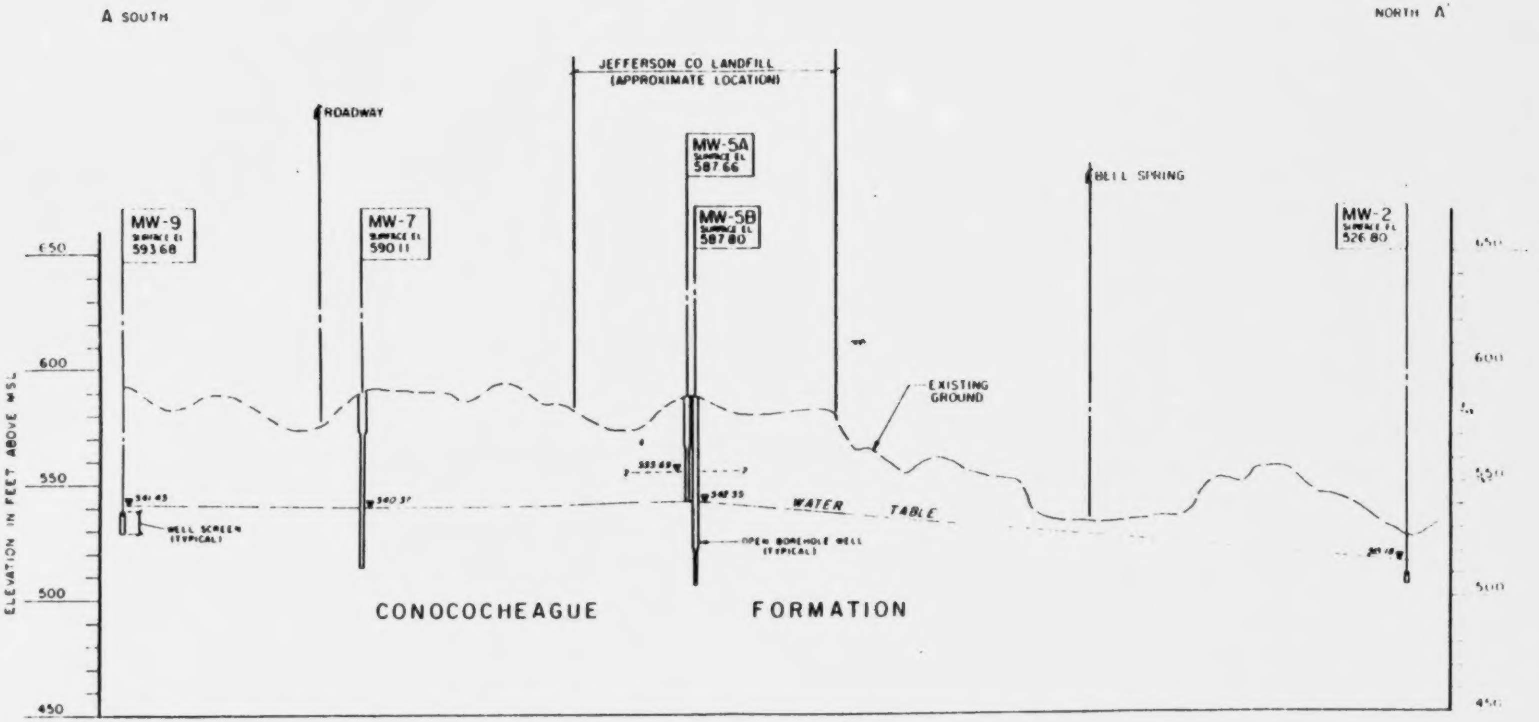
Figure 11

-10-b


A SOUTH
NORTH A'
JEFFERSON CO LANDFILL
(APPROXIMATE LOCATION)
ROADWAY
MW-5A
SURFACE EL
587.66
MW-5B
SURFACE EL
587.80
BELL SPRING
MW-9
SURFACE EL
593.68
MW-7
SURFACE EL
590.11
MW-2
SURFACE EL
526.80
650
600
550
500
450
ELEVATION IN FEET ABOVE MSL
EXISTING
GROUND
541.45
540.37
553.69
542.35
WATER TABLE
WELL SCREEN
(TYPICAL)
OPEN BOREHOLE WELL
(TYPICAL)
CONOCOCHEAGUE FORMATION

GEOLOGIC CROSS SECTION A-A'
LEETOWN PESTICIDE SITE, LEETOWN, WV
SCALE 1"=500' HORIZONTAL, 1"=50' VERTICAL

Figure 12

G-2. Chemical Data:

Sampling of the monitoring wells installed during the Phase 1 wells revealed no evidence of pesticide contamination. While it is likely that the network of 14 monitoring wells over an area as large as the site may not be adequate to monitor the karst aquifer, the very low water solubility of pesticides and their high tendency to adsorb to sediment make groundwater contamination unlikely.

An example of the immobility of the pesticides occurs at the former pesticide pile area where high concentrations of contamination in this area appear confined to the upper 6 inches of clay soil in the pile area and adjacent surface drainage. The aquifer in this area occurs under unconfined laminar flow conditions with a depth to the water table of only 15 feet. Infiltration to the aquifer after storm events was found to be rapid in this area. Yet monitoring wells located 200 feet downgradient from the center of the pile area show no evidence of contamination. Organic and inorganic results for ground water samples obtained from monitoring wells in the vicinity of the former pesticide pile area indicate that ground water in this vicinity is not contaminated by neither pesticides nor the inorganic contaminants of concern (arsenic, lead, and mercury). The assessment of ground water contamination potential for pesticides revealed that contamination in this area does not pose a threat to groundwater. Modeling indicates that approximately 200 years will transpire before the 4,4'-DDT will infiltrate throught the vadose zone to the water table. The predicted worst case, long-term concentration, is approximately 4×10^{-2} ug/l. Additional groundwater investigation in this area because of concern over pesticide contamination appears unwarranted.

No organic or pesticide contamination was detected in monitoring wells near the WVDOH garage. In addition, lead and other inorganic analytes were not detected (above drinking water standards) in the groundwater samples obtained from the monitoring wells near the garage.

Table 3 summarizes the organic and inorganic chemicals detected in groundwater samples from monitoring wells near the Jefferson County Landfill. The table reveals that only low levels of readily leachable volatile and acid extractable organic contaminants were detected in these groundwater samples. 1,1-dichloroethane, tetrachloroethene, trichloroethene, 1,2-dichloroethene, phenol, and 2-butanone (methyl ethyl ketone) were detected infrequently and at low concentrations (i.e., less than three samples contained each of the organic chemicals, and with the exception of methyl ethyl ketone (38 ug/l), no organic substance was detected in excess of 5 ug/l). These results, as well as those for residential and domestic wells sampled in the Leetown area, indicate very limited impact on groundwater quality attributable to disposal of organic wastes in the county landfill.

Table 3

HSL CHEMICALS DETECTED IN GROUNDWATER SAMPLES
JEFFERSON COUNTY LANDFILL MONITORING WELLS
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA

(Based on analytic results for samples collected by
NUS Corporation, 1985)

CAS #	Chemical	Concentration Range (ug/l)	Detection Frequency
	Organics		
78-93-3	2-butanone	38	1/13
75-34-3	1,1-dichloroethane	3 - 5	2/13
127-18-4	tetrachloroethene	2 (all)	3/13
79-01-6	trichloroethene	1 - 3	2/13
156-60-5	1,2-dichloroethene	2	1/13
108-95-2	phenol	6 - 9	3/13
65-85-0	benzoic acid	11	1/13
84-74-2	di-n-butylphthalate	115	1/13
	Inorganics		
7429-90-5	aluminum	59 - 190	8/13
513-77-9	barium	57 - 245	13/13
100-44-7	beryllium	0.6 - 0.7	2/13
7440-43-9	cadmium	6.4	1/13
7440-70-2	calcium	59,490 - 184,600	13/13
7440-47-3	chromium	4.3 - 15	4/13
7440-48-4	cobalt	11 - 14	2/13
7440-50-8	copper	5.7 - 10	5/13
1309-37-1	iron	13 - 10,900	4/13
7439-92-1	lead	6.2 - 12	3/13
7439-95-4	magnesium	7,229 - 24,950	13/13
7439-96-5	manganese	16 - 1,950	12/13
7440-02-0	nickel	24 - 29	2/13
7440-09-7	potassium	3,170 - 14,000	13/13
7440-22-4	silver	8.2 - 8.3	2/13
7440-23-4	sodium	6,190 - 37,710	13/13
7440-62-2	vanadium	11 - 11.1	2/13
7440-66-6	zinc	6.8 - 39	7/13

Source: NUS Corporation, Pittsburgh, Pennsylvania, February 1986.

Lead was present in landfill groundwater samples at a maximum concentration of 12 ug/l. Additional low-level contamination with such trace elements as cadmium (6 ug/l) and chromium (15 ug/l) was detected, but only sporadically, and results were not duplicated during successive sampling rounds. The sporadic occurrence of lead and other inorganic analytes in the groundwater samples, as well as their relatively low concentrations, indicate that substantial amounts of metals are not being released form the landfill at this time. Substantial amounts of clay are present in the overburden in the Leetown area. The clay and the expected high concentrations of calcium carbonate in this karst area may substantially retard release and transport of metals via precipitation of insoluble salts (carbonates) or through cation exchange.

H. The Biotia Investigation

Potential receptors of contamination from the Leetown Site include the local biota, principally aquatic life and waterfowl. No specific survey of naturally-occurring terrestrial vegetation was conducted, since this medium appears to be neither a potential receptor of contamination, nor a means of contaminant transport. Over half of the watershed consists of pasture or is under cultivation. Clearing of land for agricultural use, and active management of cleared areas for crop production represent the most significant impacts to terrestrial vegetative habitats within the watershed. Most of the land near the potential sources of contamination is in pasture or row crop production, providing little diversity of habitat for colonization by wildlife. Most of the diversity of cover types in these areas in provided by fencerows occupied by woody shrubs and brambles.

H-1. Aquatic Survey:

A primary objective of the aquatic survey at the Leetown Site was to evaluate the potential for adverse effects to fish and higher trophic levels, including man, as a result of accumulation of contaminants via the aquatic food chain. In addition, the general condition of the aquatic community was investigated as an indication of the overall extent of contaminant impact to the watershed.

The aquatic survey consisted of fish collection for tissue analysis to determine potential uptake of pesticides through the aquatic food chain, collection of benthic macroinvertebrate samples to serve as an indicator of the extent of contaminant impact, and subjective assessment of the aquatic community. Subjective assessment of the benthic sample collections in the field indicated that further identification and classification of the samples would probably not yield diversity indices sufficiently different from one another. The benthic samples were therefore consigned to secure storage and were available if needed to supplement the ongoing evaluation.

H-2. Fish Survey:

A total of eight sampling stations were selected, representative of the Bell Spring Run, Hopewell Run, and Blue and Gray Spring Run watersheds, and the National Fisheries Center (NFC). An overall ecological assessment of the aquatic community was conducted, and fish tissue samples were obtained to be analyzed for both organic and inorganic constituents of the HSL. Sampling procedures adopted for the survey included electrofishing, seining, gillnetting, and use of minnow traps.

H-3. Physical Data:

A total of 25 benthic macroinvertebrate samples were collected, preserved in 10 percent formalin, and placed in secure storage . As noted above, a decision was made based on field examination of the benthos to defer further evaluation of the benthic samples.

A total of 4,911 fish were collected during the aquatic investigation. These fish represented 7 families and 16 species. Totals of 23 and 20 samples of adequate weight for laboratory analysis were prepared for respective analysis for organic and inorganic constituents on the HSL.

Based on a subjective evaluation of the numbers of individuals and species found in the collections from Bell Spring Run and from the drainage from Blue and Gray Springs, it appears that all trophic levels are represented, and that the overall community structure is stable. No significant evidence was found, for example, in the Bell Spring Run collections made in the vicinity of the former pesticide mixing area indicating adverse effects on the fish population.

With respect to subjective examination of the benthic community, there appears to be evidence of nutrient input into Link and Bell Spring Run from pastures and crop areas. In particular, this was noted in the vicinity of Bell Spring Run and Route 15/1, in an area that was at one time a pig sty. It did not appear, based on the available data, that significant additional information would be obtained by a more thorough evaluation of the 25 benthic samples currently preserved and in secure storage.

H-4. Chemical Data:

HSL organic and inorganic analytical results for fish samples obtained from Bell Spring Run are presented in Table 4. Since fish are free to move along the entire course of Bell Spring Run, specific samples provide no indication of contamination in specific locations. Because of their bioconcentration factors, pesticides display a marked tendency to accumulate in tissues of aquatic organisms. This phenomenon is verified by the analytical results for fish tissues. Total concentrations of pesticide compounds ranged as high as 1,800 ug/kg. Pesticides were the only organic analytes detected in fish tissues, reflective of their bioaccumulative tendencies and their pervasiveness in the surrounding watershed.

The predominant inorganic substances detected in the various source areas (i.e., arsenic, mercury, and lead) were virtually undetected in fish tissues. Other analytes detected in surface water samples above the Ambient Water Quality Criteria for protection of aquatic life (i.e., chromium, copper, and zinc) were found in fish tissues at relatively low levels. These trace elements occur naturally in the environment and are

Table 4

FISH SAMPLE ANALYTICAL RESULTS
BELL SPRING RUN
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA
(Results reported in µg/kg)

Chemical								
Sample Number	FI-007	FI-008	FI-012	FI-013	FI-017	FI-019	FI-020	FI-023
Location	Bell Spring	Bell Spring	Marsh	Marsh	Bell Spring	Bell Spring	Bell Spring	Marsh
Sample Type	Minnow-Comp.	Minnow-Comp.	Carp fillet	Carp organs	Dup-007	Sculpin/Dace Comp.	Sculpin/Dace Comp	Minnow Comp
Percent Lipid	2.4	1.7	0.75	8.4	2.1	2.7	3.0	3.6
Sample Date	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84	11/15/84
Phthalate Esters								
diethyl phthalate						190J,B,R	420J,B,R	
di-n-butyl phthalate	800B,R	840B,R	1,200B,R					
bis(2-ethylhexyl)phthalate								
Pesticides/PCBs								
4,4'-DDE	690	1,800	110	750R	850	1,300	310	870
4,4'-DDD	62	110	15	110R'	63	78	30	79
4,4'-DDT							9J	
Miscellaneous Compounds								
n-nitrosodiphenylamine							120J,B,R	
Inorganics (mg/kg)								
aluminum	84J	80J	1.5J	35J	39J	39J	22J	36J
barium	1.9	2.4	0.08	1.6	2.4	2.2	1.8	3.9
calcium	11,400	15,300	479	5,540	14,800	12,300	10,300	11,400
chromium	0.37	0.56	0.12	0.42	0.52	0.50	0.51	0.39
copper	1.7	1.2	1.0	3.3	1.9	0.86	0.99	0.57
iron	70	76	8.1	159	61	40	40	51
lead		0.21						
magnesium	391	487	279	199	315	381	342	338
manganese	5.4J	7.4J	0.20J	5.6J	6.9J	4.1J	4.2J	4.5J
nickel	0.82	0.88	0.32	0.43	0.63	0.66	0.69	0.63
potassium	2,650	2,900	3,450	3,160	2,510	2,450	2,250	2,740
selenium		0.54J	0.52J	0.72J	0.98J		0.47J	0.52J
sodium	838	1,100	218	943	837	829	783	1,100
tin	0.41R	0.49R	0.36R	0.66R	0.62R	0.74R		0.58R
vanadium		0.14		0.09	0.11	0.11		0.11
zinc	41	62	8.8	124	49	38	21	44

generally necessary constituents for normal body functions. The maximum concentrations of these chemicals were detected in the organs of a bottom feeding fish (carp). The concentrations detected in the edible portion of this fish (i.e., the fillet) were much lower than these levels.

I. Soils Investigation

I-1. Background Samples:

Historical evidence and chemical analytical results for surface soil samples collected in the vicinity of the site indicate that agricultural pesticides have been used in the past and are presently found in the soil at background levels in areas other than where direct agricultural application occurred (orchards and crop fields). Background concentrations have been established for comparative purposes to aid in identifying contaminated areas. Since inorganic HSL chemicals occur naturally in the ambient environment, results for samples obtained in background areas provide a means of gauging the extent of contamination with trace elements.

Table 5 presents background levels for HSL organic and inorganic substances detected in samples collected in areas where no evidence of pesticide use exists. Concentration ranges for detected chemicals and average values for each analyte are also presented in Table 5.

4,4'-DDT and 4,4'-DDE were sporadically detected in background samples at relatively low levels. Toxaphene was detected in a background composite sample at a concentration 1,179 ug/kg. This is considered an anomalous occurence; actual background toxaphene concentrations are considered nearer or below the lower end of the reported concentration range. The presence of these pesticides in background samples are indicative of the use of these substances for agricultural purposes. Their presence in areas other than those specified as agricultural areas such as orchards or other crop fields is probably attributable to surface water or atmospheric transport. Although these substances were detected in some background samples, their occurence was somewhat sporadic, as shown by the frequency of occurence.

Five of the twenty-six background soils samples were subjected to inorganic analysis. Table 5 indicates that all but two analytes were detected in all five of the samples submitted for inorganic analysis. Arsenic and sodium were detected in only three of the samples.

I-2. Suspected Pesticide Landfarm (Lloyd Property):

Numerous organic compounds were detected in samples from the suspected pesticide landfarm, including: toluene, phthalates and polynuclear aromatic hydrocarbons (PNAs).

Pesticides detected in samples from the suspected pesticide landfarm include alpha-BHC, beta-BHC, delta-BHC, gamma-BHC (lindane), aldrin, heptachlor epoxide, dieldrin, 4,4'-DDT, 4,4'-DDD, 4,4'-DDE, endosulfan II, and toxaphene. Of these analytes, only toxaphene was detected frequently (i.e., in 35 of 78 soil samples collected in this area). Concentrations of toxaphene ranged as high as 1,100 ug/kg (ppb). Other

Table 5

HSL CHEMICALS DETECTED IN BACKGROUND SOIL SAMPLES
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA
(Based on analytical results for
samples collected by NUS Corporation, 1984/1985)

		Surface Soil Samples			
CAS#	Chemical	Concentration Range	Detection Frequency	Average	σ_n
	Organics (μg/kg)				
50-29-3	4,4'-DDT	5.0	1/26	0.2	1.0
74-54-8	4,4'-DDE	4.4-36	6/26	4.1	9.1
	toxaphene	62-1,179	5/26	110	290
	Inorganics (mg/kg)				
7429-90-5	aluminum	8,460-15,000	5/5	11,000	3,000
7440-38-2	arsenic	6.5-7.8	3/5	4.2	3.5
513-77-9	barium	52-74	5/5	65	8.2
100-44-7	beryllium	1.3-1.7	5/5	1.4	0.15
7440-70-2	calcium	1,310-2,730	5/5	2,100	560
7440-47-3	chromium	23-38	5/5	29	5.2
7440-48-4	cobalt	9.8-19	5/5	14	3.5
7440-50-8	copper	9.5-16	5/5	12	2.4
1309-37-1	iron	17,900-27,800	5/5	21,000	3,700
7439-92-1	lead	17-30	5/5	22	4.5
7439-95-4	magnesium	914-3,860	5/5	2,100	1,100
7439-96-5	manganese	510-1,110	5/5	840	250
7440-02-0	nickel	11-19	5/5	14	2.9
7440-09-7	potassium	341-1,160	5/5	680	290
7440-23-4	sodium	19-36	3/5	16	14
7440-62-2	vanadium	32-50	5/5	36	6.9
7440-66-6	zinc	22-41	5/5	33	6.7

σ_n - standard deviation based on n (26 or 5) occurrences
Source: NUS Corporation, Pittsburgh, Pennsylvania, February 1986.

pesticides were detected infrequently, and at relatively low levels, in contrast to the toxaphene concentrations. Toxaphene is one of the most water soluble, and hence, most hydrologically mobile pesticides detected in soil samples from the Lloyd property. Modeling efforts indicated that even this most pervasive, concentrated, and mobile chemical may contamiate groundwater beneath the suspected landfarm at theoretical worst case concentrations of approximately 4×10^{-3} ug/l (below the minimum instrument detection limits). Potential human exposure may occur through direct dermal contact or through inhalation of fugitive dust or vehicular tillage emissions.

Contamination with other organic analytes (including various volatiles, phthalate esters, and polynuclear aromatic hydrocarbons) is also evident. These substances were infrequently detected and concentrations were generally on the order of instrument detection limits. Groundwater contamination with these chemicals is considered unlikely in light of the results of the toxaphene modeling effort, the low concentrations detected, and the generally immobile nature of these chemicals.

Comparison of the inorganic results at the suspected landfarm with the background levels presented in Table 5 reveals that most inorganic analytes were detected at background levels in the Lloyd property soil samples. Exceptions include antimony, arsenic, cadmium, lead, mercury, selenium, silver, and tin. Of these, all but lead were detected infrequently (i.e., in less than 10 of 68 samples collected). The sporadic occurrence of these substances and the relatively low concentrations indicate little inorganic contamination in the suspected landfarm. Although lead was detected somewhat more frequently (i.e., in 46 of 68 samples), only seven samples contained lead above the maximum detected background concentration of 30 mg/kg. Of these seven, six samples contained lead at a concentration below 40 mg/kg. The only apparent anomalous occurrence was the presence of lead in one sample at a concentration of 133 mg/kg. Lead and other trace element concentrations do not seem to differ significantly enough from background to indicate an inorganic contaminant source on the Lloyd property.

I-3. Crimm Orchard (Tabb Property):

4,4'-DDT and 4,4'-DDE were present in soils in the former Crimm Orchard in excess of "natural" soil background levels of areas not associated with pesticide application. Concentrations ranged as high as 2,447 ug/kg (ppb) for 4,4'-DDT and 1,774 ug/kg (ppb) for 4,4'-DDE. The presence of the pesticides in soil samples from this area is considered indicative of the use of DDT for agricultural purposes. This orchard contained the lowest concentrations of 4,4'-DDT and metabolites of any of the orchard areas sampled. Thus, it is considered likely that the use of pesticides in this area was not as prevalent as in other orchards in the study area. These samples can be used as background samples when compared to disposal areas (i.e., Pesticide pile mixing areas) which are located within the boundaries of the former orchards. The formulation (i.e., mixing of solid matrix pesticides with water for spraying or bomb application) and storage of pesticides was practiced in an apple-packing shed in this area. Drums containing pesticide substances were found in this shed during the NUS investigation and pesticides were detected in soil samples from beneath the shed and in its immediate vicinity.

Pesticide concentrations in this area are in excess of both "natural" soil background levels and the pesticide concentrations detected in soil samples from the Crimm Orchard proper.

Summaries of analytical results for soil samples collected in and around this packing shed (also referred to as the Tabb barn) are presented in Table 6. This table reveals that 4,4'-DDT, 4,4'-DDD and 4,4'-DDE are present in this area at maximum concentrations of 9,000, 4,000, and 9,000 ug/kg (ppb), respectively.

Total concentrations of 4,4'-DDT and metabolites reached 22,000 ug/kg in the vicinity of the packing shed (a sample from below the floor). This maximum value is in excess of both the "natural" soil concentration of approximately 4 ug/kg and the "background" Crimm Orchard concentration of approximately 4,000 ug/kg.

Results for inorganic analytes detected in samples obtained from this area are also presented in Table 6. The following analytes were detected in these samples in excess of background concentrations: arsenic, cadmium, copper, lead, mercury, silver, tin, and zinc. Of these, arsenic, mercury, lead, and zinc were detected frequently and at concentrations considered significantly in excess of background. Arsenic, lead and mercury are of some concern from a toxicological viewpoint.

I-4. Jefferson Orchard (USF&W Property):

Table 7 summarized the HSL organic results for soil samples obtained from the Jefferson Orchard located to the north of Bell Spring Run and west of Route 15/1. Various phthalate esters, polynuclear aromatic hydrocarbons, and benzoic acid were detected in these samples. These results were all quantified below the method detection limits for these samples. These results are considered of relatively little significance, in view of their sporadic occurence, particularly when contrasted with the results for pesticides detected in these samples.

4.4'-DDT, 4,4'-DDD, and 4,4'-DDE were detected in all five samples obtained from this orchard at maximum concentrations of 7,600, 300, and 8,000 ug/kg (ppb), respectively. Such results are evidence.of extensive use of pesticides in this orchard, These concentrations are higher than those detected in the Crimm Orchard. Total 4,4'-DDT and metabolite concentrations range to approximately 16,000 ug/kg.

The results of these samples can also be used as background levles when compared with disposal areas, such as the pesticide pile and the mixing areas, that are located within the former boundaries of the old orchards.

Inorganic samples from the orchard area indicate levels of Arsenic at 38 mg/kg on average with a maximum detection of 53 mg/kg. Lead levels in these areas are detected at an average of 209 mg/kg, and a maximum of 341 mg/kg.

Table 6

HSL CHEMICALS DETECTED IN SAMPLES
FROM THE CRIMM ORCHARD PACKING SHED (TABB BARN)
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA

(Based on analytical results for
samples collected by NUS Corporation, 1985)

		Surface Soil Samples	
CAS#	Chemical	Concentration Range	Frequency of Occurrence
	Organics (ug/kg)		
50-29-3	4,4'-DDT	20-9,000	5/5
74-54-8	4,4'-DDD	100-4,000	3/5
72-55-9	4,4'-DDE	30-9,000	5/5
	Inorganics (mg/kg)		
7429-90-5	aluminum	5,383-10,498	5/5
7440-38-2	arsenic	3-26	5/5
513-77-9	barium	50-97	4/5
7440-43-9	cadmium	0.7	1/5
7440-70-2	calcium	6,608-38,115	5/5
7440-47-3	chromium	10-31	1/5
7440-48-4	cobalt	5	5/5
7440-50-8	copper	12-80	5/5
1309-37-1	iron	6,625-17,022	5/5
7439-92-1	lead	63-725	5/5
7439-95-4	magnesium	591-2,569	5/5
7439-96-5	manganese	39-655	5/5
7439-97-6	mercury	0.18-0.52	5/5
7440-02-0	nickel	5-6	2/5
7440-09-7	potassium	527-976	3/5
7440-22-4	silver	1 (both)	2/5
7440-31-5	tin	7	1/5
7440-62-2	vanadium	7-28	5/5
7440-66-6	zinc	52-234	5/5

Source: NUS Corporation, Pittsburgh, Pennsylvania, February 1986.

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Table 7

HSL CHEMICALS DETECTED IN SAMPLES FROM THE FORMER JEFFERSON ORCHARD (USFWS PROPERTY)
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA

(Based on analytical results for samples collected by NUS Corporation, 1985)

CAS #	Chemical	Surface Soil Samples	
		Concentration Range (µg/kg)	Detection Frequency
84-66-2	diethylphthalate	1,240K	1/5
84-74-2	di-n-butyl phthalate	589K - 1,240K	4/5
117-81-7	bis(2-ethylhexyl)phthalate	589K - 1,220K	3/5
91-20-3	naphthalene	589K	1/5
129-00-0	pyrene	883K	1/5
65-85-0	benzoic acid	8,830K	1/5
50-29-3	4,4'-DDT	4,500 - 7,600	5/5
74-54-8	4,4'-DDD	50 - 300	5/5
72-55-9	4,4'-DDE	2,900 - 8,000	5/5

K - laboratory qualifier indicating compound present below the detection limit provided.

Source: NUS Corporation, Pittsburgh, Pennsylvania, February 1986.

I-5. Jefferson Orchard (Robinson Property):

Numerous soil samples were obtained from this property, with the majority taken from areas influenced by the former pesticide pile area. Soil samples indicative of agricultural use (orchard) include one composite soil sample from the orchard area proper, and several samples from the vicinity of the pesticide mixing area.

Organic results for the composite soil sample obtained in the easternmost protion of the Jefferson Orchard are presented in Table 8. These results indicate that 4,4'-DDT and 4,4'-DDE are present in surface soil concentrations of 7,130 and 6,925 ug/kg (ppb), respectively. Thus, it appears that agricultural background concentrations of 4,4'-DDT and its metabolites are approximately 14,000 ug/kg (ppb) in this area. This is similar to concentrations detected on the USF&WS property. Trace element concentrations are expected to be similar to "natural" soil background levels (Table 5).

Inorganic levels from the Jefferson Orchard at the Robinson Property show arsenic in the soils at 117 mg/kg (avg.) and lead in two samples at 474 mg/kg and 991 mg/kg.

I-6. Former Jefferson Orchard Pesticide Mixing Area (Robinson Property):

Results for samples obtained from the pesticide mixing area located on the Robinson Property (Table 9), reveals the presence of methylene chloride, di-n-butyl phthalate, 4,4'-DDT, 4,4'-DDD, 4,4'-DDE, and endosulfan sulfate. Methylene chloride and di-n-butyl phthalate were detected in one of six and two of seven samples, respectively. Methylene chloride was detected at a concentration of 46 ug/kg. Both di-n-butyl phthalate results were present in the laboratory reagent blank associated with the samples. Both methylene chloride and phthalate esters are common laboratory contaminants. The sporadic occurrence and relatively low concentrations of these substances do not indicate any substantial contamination with HSL organic analytes other than pesticides in this area.

4,4'-DDT and its metabolites, as well as endosulfan sulfate, were detected at much higher concentrations and generally more frequently in soil samples from this area. 4,4'-DDT, 4,4'-DDD, 4,4'-DDE, and endosulfan sulfate were detected at maximum concentrations of 59,000, 50,000, 48,000 and 59,000 ug/kg (ppb), respectively. The concentrations are in excess of the concentrations detected in both "natural" soil and "background" Jefferson Orchard soil and may be considered residual contamination associated with formulation of pesticides in this area.

In the Mixing Area arsenic was detected in composite samples on the average of 62 mg/kg and lead at 199 mg/kg.

I-7. Former Pesticide Pile Area (Robinson Party):

Table 10 presents a summary of the pesticide and inorganic chemicals detected in soil samples from the former pesticide pile area. Hexachlorobenzene, chrysene, phenanthrene, fluoranthene, alpha-BHC, beta-BHC, gamma-BHC, 4,4'-DDT, 4,4'-DDD, 4,4'-DDE, and endrin were detected. Except for the pesticides, all organic analytes were quantified below

Table 8

HSL CHEMICALS DETECTED IN SAMPLES FROM THE FORMER JEFFERSON ORCHARD (ROBINSON PROPERTY)
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA
(Based on analytical results for samples collected by NUS Corporation, 1985)

CAS #	Chemical	Surface Soil Samples	
		Concentration Range (µg/kg)	Detection Frequency
50-29-3	4,4'-DDT	7,130	1/1
72-55-9	4,4'-DDE	6,925	1/1

CAS# = Chemical Abstract Service No.
Source: NUS Corporation, Pittsburgh, Pennsylvania, February 1986.

Table 9

HSL CHEMICALS DETECTED IN SAMPLES FROM THE PESTICIDE MIXING AREA
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA

(Based on analytical results for samples collected by NUS Corporation, 1984-1985)

CAS #	Chemical	Surface Soil Samples: Concentration Range	Surface Soil Samples: Detection Frequency
	Organics (µg/kg)		
75-09-2	methylene chloride	46	1/6
84-74-2	di-n-butyl phthalate	1,080B - 1,790B	2/7
50-29-3	4,4'-DDT	800 - 59,000	7/7
74-54-8	4,4'-DDD	700 - 50,000	5/7
72-55-9	4,4'-DDE	3,800C - 48,000	7/7
1031-07-8	Endosulfan sulfate	58,000 - 59,000	2/7
	Inorganics (mg/kg)		
7429-90-5	aluminum	3,690 - 11,200	3/3
7440-38-2	arsenic	23 - 110	3/3
513-77-9	barium	133 - 160	3/3
100-44-7	beryllium	0.81 - 2.1	3/3
7440-70-2	calcium	28,900 - 181,000	3/3
7440-47-3	chromium	14 - 33	3/3
7440-48-4	cobalt	4.9 - 12	2/3
7440-50-8	copper	23 - 48	3/3
1309-37-1*	iron	7,850 - 10,600	3/3
7439-92-1	lead	104 - 328	3/3
7439-95-4	magnesium	1,770 - 3,010	3/3
7439-96-5	manganese	175-450	3/3
7439-97-6	mercury	0.1 - 0.3	2/3
7440-02-0	nickel	12 - 13	3/3
7440-09-7	potassium	296 - 1,430	3/3
7440-22-4	silver	3.5 - 3.6	2/3
7440-23-5	sodium	27 - 145	3/3
7440-62-2	vanadium	9.6 - 21	3/3
7440-66-6	zinc	36 - 376	3/3

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3 C - laboratory qualifier indicating pesticide presence confirmed by GC/MS.
4 B - laboratory qualifier indicating compound detected in lab reagent blank.
5 * - CAS # (Chemical Abstract Service No.) presented for iron (III) oxide.

Source: NUS Corporation, Pittsburgh, Pennsylvania, February 1986.

17-C

Table. 10

Pesticides Detected in Samples From Soils in the Former Pesticide Pile Area

Pesticide	Concentration Range (ug/kg)	Frequency of Occurence
BHC (alpha)	17-8,700	12/25
BHC (beta)	87-95	2/25
BHC (gamma)	80-220	3/25
4,4'-DDT	430-250,000	25/25
4,4'-DDD	220-16,000	18/25
4,4'-DDE	220-110,000	25/25
Endrin	8,000	1/25

All DDT, DDD, DDE and BHC (alpha) results were confirmed by GC/MS analysis.

the method detection limits associated with the samples. In addition to the low concentrations exhibited by the base/neutral/acid extractables, these substances were infrequently detected (i.e., in two or less of the twenty-five samples analyzed). The pesticides (particularly 4,4'-DDT and its metabolites, and alpha-BHC) were detected much more frequently and at significantly higher concentrations. Maximum concentrations detected for 4,4'-DDT, 4,4'-DDD, 4,4'-DDE, and alpha-BHC were 250,000, 16,000, 110,000, and 8,700 ug/kg (ppb), respectively. These results are in excess of both "natural" soil background and Jefferson Orchard "background" soil concentrations, and are believed to be residual contamination from disposal of pesticide debris in this area.

Contrast of the inorganic results for samples obtained in this area with the "natural" soil background levels in Table 5 reveals that several inorganic substances are present above the naturally occurring background concentrations. The results for arsenic, lead, and mercury are of particular interest and are illustrated on Table 11.

The average concentration of arsenic and lead in the pile area is 137 mg/kg and 284 mg/kg respectively. When compared to the average concentration in the Mixing Area (As. 62 mg/kg; Pb. 199 mg/kg) and in the Orchard Areas (As. 56 mg/kg and Pb. 325 mg/kg), there is little significant statistical difference in the concentration.

I-8. West Virginia Department of Highways (WVDOH) Garage Landfill:

Samples were collected in this area to assess potential impacts on groundwater in the Leetown area, since landfilling was also reportedly practiced in this area.

Di-n-butyl phthalate (698 ug/kg), 4,4'-DDT (120 ug/kg), 4,4'-DDD (7.1 ug/kg), and 4,4'-DDE (100 ug/kg) were detected in 1,4,2, and 3 of 6 soil samples obtained from the garage area, respectively. The presence of the pesticides in soil may be attributable to airborne transport of contaminated particulates from agricultural areas in the vicinity of the garage.

The inorganic results for soil samples obtained in this area indicate that lead is present in soil at 133 mg/kg in one sample. The occurence of lead at this location may be associated with vehicular emissions.

J. Summary of Conditions

The results of the contaminant release and exposure study indicate that the suspected landfarm and the apple orchards do not appear to comprise significant sources of environmental contamination, especially in comparison to contaminated areas such as the former pesticide pile and the two pesticide mixing/storage areas. This is discussed in detail in the Health and Environmental Impacts section (Section K) of this document. Evidence of substantial contamination was not identified in either landfilling area.

-18-a

Table 11

Lead, Arsenic and Mercury Detected in Soil Samples From the Former Pesticide Pile Area

Chemical	Concentration Range	Frequency of Occurence
Lead (Pb)	44-1,040	15/15
Arsenic (As)	21-759	15/15
Mercury (Hg)	.1-1	12/15

The three areas that present concentrations of pesticides above that of ambient soil background (non-pesticide use areas) and orchard background levels (pesticide application areas) are the following:

- Former Pesticide Pile Area (Presently: Robinson Property)
- Former Jefferson Orchard Mixing Area (Presently: Robinson Property)
- Former Crimm Orchard Packing Shed (Presently: Tabb Barn)

It is these areas that will be the focus of the Health and Environmental Impact Section of this document.

Lead and arsenic levels found in the soils of the disposal areas are comparable to levels found in the Leetown orchards and are in turn comparable to the national average for other orchard areas.

Sampling of monitoring wells and residential wells (27 in total) reveal no evidence of pesticide contamination in the ground water. Low levels of readily inorganic, volatile and acid extractable organic compounds were detected in the monitoring wells installed at the base of the Jefferson Co. Landfill. These compounds were detected infrequently and at low concentrations.

The results of the entire hydrogeologic investigation indicate very limited impact on ground water quality in the Leetown area. The assessment of ground water contamination potential for pesticides from the pesticide pile area revealed that approximately 250 years will pass before DDT will infiltrate the vadose zone to the water table. The predicted worst case, long term concentration is approximately .04 ug/l.

Surface water samples in Bell Spring and Link Spring Runs had anamolous levels of some inorganic elements. However, the concentrations of these elements were similar in both upstream and downstream samples and may be ambient background levels for this area.

DDE and lead appear to be high in sediment samples taken at sampling points corresponding to the surface water samples. Focus on these contaminants will take place in the Health and Environmental Impact Section of this document.

The Biotic Investigation reveals a healthy macroinvertibrate and fish population as far as species diversity is concerned. Samples indicated elevated levels (due to bioconcentration) of pesticides in some fish analyzed. These results will be discussed in the Health and Environmental Impact Section of this document.

K. Health and Environmental Impacts

K-1. Qualitative Risks:

K-1a. Former Jefferson Orchard (USF&WS and Robinson Property):

Table 12 shows levels of DDT in the Jefferson Orchard are comparable to those found in orchard areas throughout the United States. Because

-19-a

Table 12

Mean Pesticide Residue Concentrations at Leetown and U.S. Orchards

Pesticide	U.S. Orchards (ug/kg)	Leetown Orchards (ug/kg)
DDT/Metabolites	3,310-122,600	9,186 max
Toxaphene	7,720	ND
Aldrin	20	ND
Dieldrin	190-1,410	ND
Endrin	1,240-6,300	ND
Endosulfan	2,300	ND
Gamma-BHC (Linderne)	50	ND

the Jefferson orchard is abandoned, exposures will be minimal. However, a portion of the parcel owned by the USF&WS is used for the production of silage corn for dairy cattle at the Dodson farm. Consumption of silage and/or grasses that may have taken up pesticides could result in the eventual accumulation of DDT in the milk fat of these cows. However, milk from all dairies in the Virginia/Maryland Milk Producers Association is regularly monitored for unacceptable levels of pesticides, so exposure of the general public will be circumvented.

Fugitive dust is not a significant problem in the orchards, primarily because of the vegetative cover and the distance to receptors.

K-1b. Crimm Orchard (Tabb Property):

Erosion of the DDT found in the former Crimm Orchard will move contaminants offsite to Bell Spring Run. Unless the orchard area is put into row crops at some future time, stormwater erosion will remain the dominant contaminant transport mechanism and exposure route.

Fugutive dust will not be a significant problem in this area, primarily because the area is vegetated and there are no nearby receptors. If, however, that vegetation is disturbed by future agricultural activities, fugitive dust could become slightly more significant. Agricultural activity will result in both dermal and inhalational/ingestional exposures of the farmers working the land.

K-1c. Suspected Pesticide Landfarm Area (Lloyd Property):

The levels of pesticides found in the suspected pesticide landfarm area are well below the average values reported for other cornfields throughout the United States. Toxaphene is the major contaminant found on the property. Toxaphene and DDT are unlikely to move into the groundwater because of their high soil/sediment adsorption coefficients. Because of the immobile nature of toxaphene and the other pesticides found, exposures will probably occur only through dermal contact during tilling.

Eroded material from the suspected landfarm area would probably be carried to the Gray Spring watershed, which was found to be free of contamination. Therefore, it appears that stormwater runoff is not a major transport route for this area.

K-1d. Jefferson County Landfill:

This landfill is an active facility currently administered by the Jefferson County Commission. The landfill presents no identifiable current risk to residents or workers. No significant hazardous constituents were found in any of the monitoring wells that encircle the landfill, and nearby residential wells were also clean. Monitoring wells were installed around the landfill only in an attempt to determine whether it presented a current risk to any potential receptors. The composition of the buried wastes was not studied, therefore the potential for future exposures or risks is not known.

K-1e. WVDOH Garage Landfill:

As with the county landfill, this is an active facility that is currently administered by the State of West Virginia. The WVDOH garage and its landfill were investigated as part of this study in order to determine whether it presents a risk to any receptors. Wells installed near the facility as well as its water supply were found to be free of contamination. No exposure pathway could be identified for this area, therefore the site appears to present no risk.

K-1f. Former Pesticide Pile Area:

The highest concentrations of pesticides and several inorganics (arsenic, lead and mercury) were found in the samples collected from the former pesticide pile area. The nature of these contaminants causes them to adsorb to soil particles. Contaminants will be released only when the soil is disturbed.

One potential release mechanism that was evaluated for the pesticide pile area is the generation of fugitive dust from the unvegetated area. Winds may entrain dry soil particles and move them offsite to human receptors.

Another release mechanism, which could also result in human exposure, is agricultural activity such as plowing or harvesting. The pesticide pile area is currently in pasture, but there is a possibility that the soil could be tilled at some future time. If plowing should occur, it would most likely take place over the entire Robinson property, and therefore, the farmer would be exposed to average, areawide contaminant concentrations. Both dermal and inhalational/ingestional exposures would occur from agricultural activities.

K-1g. Pesticide Mixing Area:

Soils surrounding the former Jefferson Orchard pesticide mixing area exhibit high levels of pesticides, second only in concentration to the former pesticide pile area. Soil disturbance will be the major contaminant release mechanism.

Because the former mixing area is well-vegetated, overland flow (runoff) will not be a major route of transport. However, minor erosion could occur, and if it did, contaminants would be transported directly to Bell Spring Run because of its proximity, thereby entering the aquatic food chain. In this area there would be less chance for these contaminated soils to mix with other contaminated soils because of the area's proximity to the stream.

Fugitive dust will not present a problem in this area because of the established vegetative cover. However, grazing could occur because the area is within the fence on the Robinson property.

Tilling the soil around the existing foundation could result in both dermal and inhalation/ingestional exposure as described for the former pesticide pile area. As with that area, the mixing area is not currently under cultivation. If the land should be rotated into row crops and if it were plowed close to the foundation, exposure could occur.

K-1h. Former Crimm Orchard Packing Shed:

The soils beneath and immediately surrounding the packing shed are contaminated with levels of pesticides that exceed the levels found in the surrounding orchard area. These pesticides will only be released to the environment when the soils are disturbed in some way.

Presently, wind-blown dust and soil erosion are not problems because there is vegetation around the shed. While it is possible for some erosion to occur, vegetation between Bell Spring Run and the contaminated soils would preclude contaminants from entering the aquatic food chain.

If the area immediately adjacent to the shed, and particularly the soils beneath the shed (if it were razed), should be plowed at some future time, farmers would experience both dermal and inhalational/ingestional exposure.

K-2. Environmental Risks:

Preliminary estimates were made of the amount of contaminated soil that may enter the streams from the identified source areas. Average pesticide concentrations in the orchards were used for the calculations in order to more accurately assess actual contaminant loading. Although concentrations from the actual pesticide pile were not used, average DDT concentrations for the former Jefferson Orchard (Robinson property) were used as an estimate of sediment "dilution" during a 25-year rainfall event. After the expected rapid settlement of these sediments, partitioning between the water and sediment was estimated using published values for soil/sediment adsorption coefficients. A bioconcentration factor was applied to the expected water concentration. It was found that the maximum predicted concentration of DDT in fish tissue would be 3.5 ppm.

The Food and Drug Administration (FDA) has set 5.0 ppm as the action level for commercial fisheries, but this value does not apply to recreational fisheries. The National Academy of Sciences (NAS) has recommended a level of 1.0 ppm for total DDT in fish for the protection of wildlife Both the observed and the NAS-recommended values are less than the worst-case predicted levels. The maximum observed DDT concentration in fish tissue was 1.8 ppm, which is approximately equal to the NAS guideline. Because of this fact, it is unlikely that wildlife will be affected by the observed levels of DDT in fish. In addition, the terrestrial habitats in the area are not unique, nor are they home to any known endangered or threatened species. Human exposure through ingestion of fhis from Bell Spring Run is unlikely because the top carnivores in this aquatic system are fallfish and creek chubs, both of which are non-game fish.

It is unlikely that contaminated sediments in Bell Spring Run would affect the activities at the NFC, even though it lies downstream of the contaminated areas. Water flow through the NFC precludes contamination of fish raised in the hatchery because the water for the hatchery comes from Gray Spring or Hopewell Run (Figure 13). However, contamination in Bell Spring Run could affect Hopewell Marsh, Reservoir A, the hatchery holding house, and the NFC Academy. The slow flow through Hopewell

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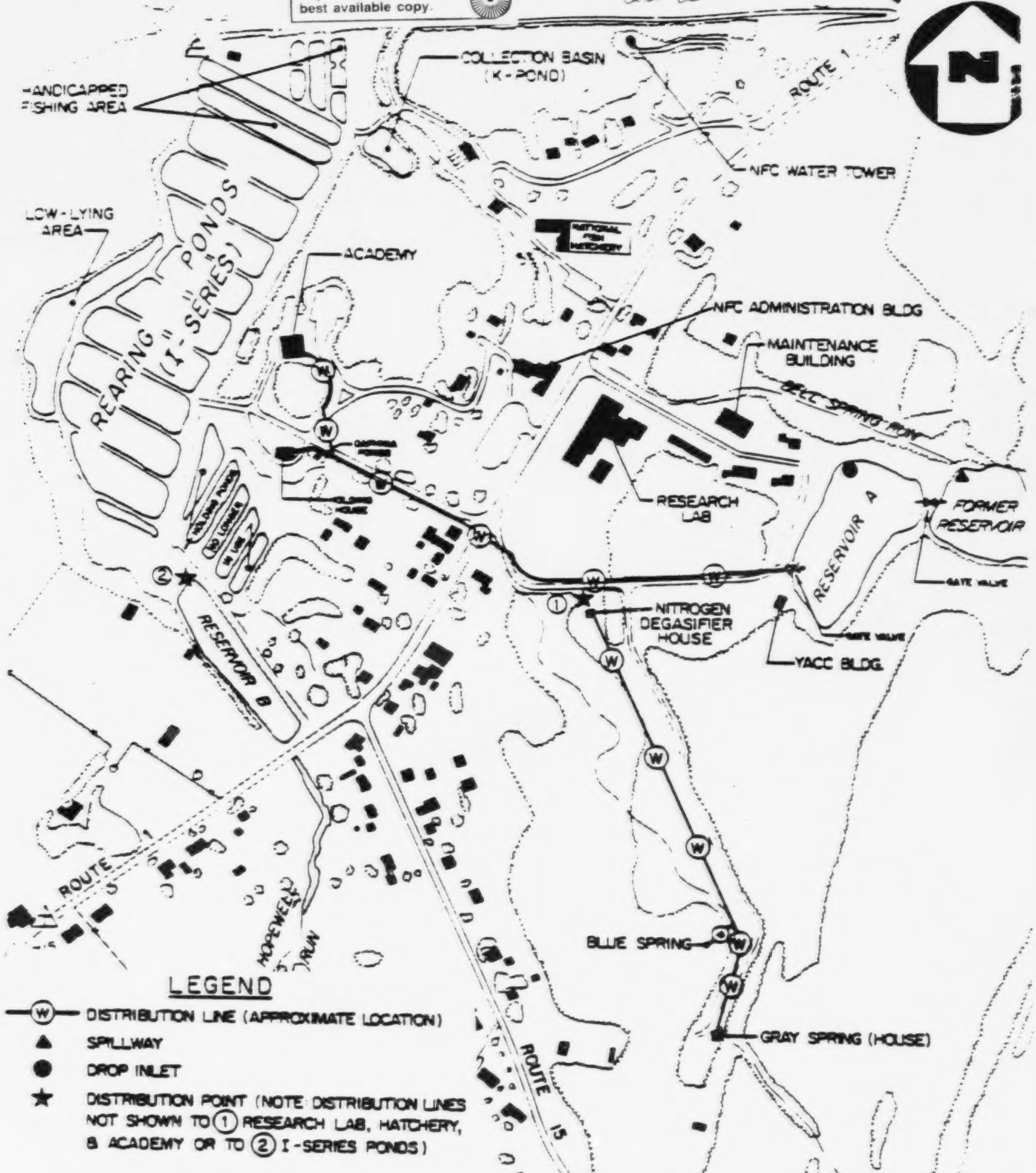
HANDICAPPED
FISHING AREA
COLLECTION BASIN
(K-POND)
ROUTE 1
N
NFC WATER TOWER
LOW-LYING
AREA
REARING "I" PONDS
(I-SERIES)
ACADEMY
NATIONAL FISH HATCHERY
NFC ADMINISTRATION BLDG
MAINTENANCE
BUILDING
BELL SPRING RUN
RESEARCH
LAB
RESERVOIR A
FORMER
RESERVOIR
GATE VALVE
GATE VALVE
NITROGEN
DEGASIFIER
HOUSE
YACC BLDG
① ②
RESERVOIR B
ROUTE 15
HOPEWELL RUN
BLUE SPRING
GRAY SPRING (HOUSE)
ROUTE 15
LEGEND
Ⓦ DISTRIBUTION LINE (APPROXIMATE LOCATION)
▲ SPILLWAY
● DROP INLET
★ DISTRIBUTION POINT (NOTE: DISTRIBUTION LINES NOT SHOWN TO ① RESEARCH LAB, HATCHERY, & ACADEMY OR TO ② I-SERIES PONDS)

WATER FLOW THROUGH THE
LEETOWN NATIONAL FISHERIES CENTER
LEETOWN PESTICIDE SITE, LEETOWN, WV
SCALE: 1" = 500'

Figure 13

Marsh would allow most, if not all, of the sediments to settle out before they reached Reservoir A. However, neither of these facilities are occupied by fish for any significant length of time. In addition, fish used in the Academy are incinerated after use and are not consumed.

The present data base is not adequate to fully characterize the threat to raptors and/or waterfowl that may feed on the fish from local streams. Development of such a data base would have requred a greatly-expanded ecological investigation. However, the approach taken to the environmental assessment is justified based on the absence of threatened or endangered species of piscivorous birds or terrestrial predators, and an objective evaluation as a result of field reconnaissance, that the potential for adverse impact to aquatic and terriestrial biota is low.

K-3. Quantitative Risks:

Carcinogen risk calculations were developed for 6 of the 8 all areas under investigation. The conclusions for each area is summarized below. It has been determined that the only areas which present a potential health risks are:

- The Pesticide Pile Area (Robinson Property)
- The Former Jefferson Orchard pesticide Mixing Area (Robinson Property)
- The Former Crimm Orchard Packing Shed (Tabb Barn)

These areas only present a threat to a certain population under a specific and conservative exposure scenerio. The exposure scenerio developed for these areas is directed at farmers who may till the land for 12 days per year, 10 hours a day over a period of 40 years. The route of exposure which presents the risk involved is through inhalation/dermal exposure to contaminated dust adsorbed during tilling operations. It should be noted that the areas in question are not presently being cultivated, and no known plans for cultivation are evident.

The other five areas of potential contamination were eliminated from alternative developement based on the risk assessment for each area or based on expected contaminant level over an area of historic application of pesticides.

A summary of the average total carcinogenic risk for 6 of the 8 site areas is found in Table 13.

The Jefferson County Landfill and the WV-DOH Landfill were not subjected to risk calculations based on the lack of significant contamination found there.

The carcinogens risk from two scenerios based on milk consumption are presented in Table 14. This illustrates that even under the most conservative exposure scenerio (i.e., drinking milk produced from one dairy farm over an expected lifetime) the calculated total carcinogen risk is 1.3×10^{-4} (1 in 7,800).

Table 13

SUMMARY OF AVERAGE TOTAL CARCINOGENIC RISKS
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA

Study Area	Dermal Exposures	Inhalational/Ingestional Exposures Including Arsenic	Inhalational/Ingestional Exposures Excluding Arsenic
Former Pesticide Pile Area	5.4×10^{-5} (1 in 18,000)	5.1×10^{-2} (1 in 20)	5.9×10^{-4} (1 in 1,700)
Pesticide Mixing Area	3.9×10^{-5} (1 in 26,000)	1.7×10^{-2} (1 in 59)	4.3×10^{-4} (1 in 2,300)
Crimm Orchard Packing Shed	5.1×10^{-6} (1 in 196,000)	4.5×10^{-3} (1 in 225)	5.7×10^{-5} (1 in 17,500)
Jefferson Orchard	7.4×10^{-6} (1 in 135,000)	*	8.2×10^{-5} (1 in 12,000)
Crimm Orchard	2.5×10^{-6} (1 in 400,000)	*	2.9×10^{-5} (1 in 34,500)
Suspected Pesticide Landfarm	6.7×10^{-7} (1 in 1,500,000)	2.8×10^{-3} (1 in 360)	7.5×10^{-6} (1 in 134,000)

Source NUS Corporation Pittsburgh, P

-23-6

Table 14

CARCINOGENIC RISK FROM MILK CONSUMPTION
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA

Contaminant	Entire Lifetime Milk Consumption Direct from Dodson Dairy Farm	Entire Lifetime Milk Consumption from MD/VA Milk Producers Association
DDT/metabolites	2.6×10^{-6}	2.1×10^{-9}
alpha - BHC	1.9×10^{-5}	1.5×10^{-8}
beta - BHC	7.9×10^{-7}	6.3×10^{-10}
gamma - BHC	2.9×10^{-7}	2.3×10^{-10}
toxaphene	9.7×10^{-5}	7.7×10^{-8}
chlordane	5.5×10^{-6}	4.4×10^{-9}
aldrin	3.7×10^{-8}	2.9×10^{-11}
dieldrin	2.6×10^{-7}	2.1×10^{-10}
Total Risk	1.3×10^{-4} (1 in 7,800)	9.9×10^{-8} (1 in 10,000,000)

NOTE: Risk is based on average concentrations of pesticides found in cornfields. For this site, the average contaminant concentrations in the suspected pesticide landfarm area were selected as being representative of cornfields in the area. Dairy farmers typically have several cornfields, and it was assumed that Mr. Dodson operates in the same manner.

Source: NUS Corporation, Pittsburgh, Pennsylvania, February 1986

A more realistic scenerio is illustrated by calculating the risk of milk consumption from the Maryland/Virginia Milk Producers Association. This total carcinogenic risk is calculated to be 9.9×10^{-8} or 1 in 10 million people. This is based on dilution of milk from the Dodson Farm and consumption of milk over a period of 70 years.

L. Remedial Action Technology Screening

The major objectives for remedial action to be taken at the Leetown Pesticide site are to mitigate or minimize potential health risks associated with the exposure scenerio described in the Health and Environmental Impacts section of this document.

Any remedial action implemented at the 3 (out of 8) sites identified as posing a significant health threat from tilling operations, must take into consideration potential impacts to any wetlands or floodplains adjacent to or part of these areas.

The National Contingency Plan specifies that remedial alternatives should be classified as either source control or offsite (management of migration) remedial actions (40CFR 300.68(d)). Source control remedial actions address situations in which hazardous substances remain at or near the areas in which they were originally located and are not adequately contained to prevent migration into the environment. Offsite remedial actions address situations in which the hazardous substances have migrated from their original locations. Alternatives developed may fall solely in either classification or may involve a combination of source control and management of migration measures, as problems at the site may dictate.

In order to determine remedial alternatives at Leetown, feasible technologies were identified for consideration. Available technologies were then screened to eliminate all but the most feasible and implementable alternatives. This screening criteria employed in identifying these technologies are as follows:

- Technical aspects
- Environmental considerations
- Public health effects
- Institutional issues
- Site specific issues
- Costs (order of magnitude comparisons)

Particular emphasis within each criteria is listed below:

- Technical aspects
  - Performance standard
  - Reliability standard
  - Implementability standard
  - Safety standard
- Environmental Considerations
  - Reduction of environmental impacts
  - Protection of natural resources

- Public health effects
    - Exposure pathway reductions
    - Migration pathway reductions
- Institutional issues
    - Compliance with NCP
    - Compliance with other environmental laws
    - Compliance with state and local regulations
- Site specific issues
    - Site conditions
- Costs
    - Capital
    - Operation and maintenance
    - Present worth analysis
    - Sensitivity analysis

A summary of technologies considered and their applicability to the Leetown site is found in Table 15.

The technologies suitable for remediation of the Leetown Pesticide Site have been identified and a preliminary evaluation of their applicability has been completed. The technologies that were retained for further evaluation and development of remedial alternatives have been summarized in Table 16.

These technologies will be combined to form the remedial action alternatives for cleanup of pesticide-contaminated soils and containerized pesticides present at the site.

M. Development of Remedial Action Alternatives

Various remedial action alternatives were developed by assembling appropriate remedial technologies into groups of actions to address the objectives of remedial action. The development of remedial action alternatives to remediate the site consistent with various categories of cleanup is required by the NCP, Section 300.68.

Table 15

GENERAL RESPONSE ACTIONS AND ASSOCIATED REMEDIAL TECHNOLOGIES
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA

General Response Action	Technologies	Comments
No Action	Some monitoring and analyses may be performed.	Applicable response.
Containment	Capping, groundwater containment barrier walls, bulkheads, gas barriers.	Capping-applicable.
Pumping	Groundwater pumping, liquid removal, dredging.	Not applicable.
Collection	Sedimentation basins, French drains, gas vents, gas collection systems.	Sedimentation control applicable
Diversion	Grading, dikes and berms, stream diversion ditches, trenches, terraces and benches, chutes and downpipes, levees, seepage basins.	Dikes, grading, trenches, stream, diversions-applicable
Complete Removal	Tanks, drums, soils, sediments, liquid wastes, contaminated structures, sewers and water pipes.	Applicable response.
Partial Removal	Tanks, drums, soils, sediments, liquid wastes.	Applicable response.
Onsite Treatment	Incineration, solidification, land treatment, biological, chemical, and physical treatment.	Applicable response.
Offsite Treatment	Incineration, biological, chemical, and physical treatment.	Applicable response.
In-Situ Treatment	Permeable treatment beds, bioreclamation, soil flushing, neutralization, land farming.	Not applicable.
Storage	Temporary storage structures.	Not applicable.

GENERAL RESPONSE ACTIONS AND ASSOCIATED REMEDIAL TECHNOLOGIES
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA
PAGE TWO

General Response Action	Technologies	Comments
Onsite Disposal	Landfills; land application.	Landfills-applicable.
Offsite Disposal	Landfills, surface impoundments, land application.	Landfills-applicable.
Alternative Water Supply	Cisterns, aboveground tanks, deeper or upgradient wells, municipal water system, relocation of intake structure, individual treatment devices.	Not applicable.
Relocation	Relocate residents temporarily or permanently.	Not applicable.

Table 16

SUMMARY OF APPLICABLE REMEDIAL TECHNOLOGIES
LEETOWN PESTICIDE SITE
LEETOWN, WEST VIRGINIA

Technology	Comment
Monitoring	Furnishes data for further assessments; status updates
Soil Cover	Contains contaminants and mitigates potential for exposure and offsite migration
Multimedia Cap	Similar to soil cover; provides greater security, better control of surface water infiltration
Excavation	Can be used to consolidate contaminants on site or to prepare contaminated media for removal options
Removal	Involves transporting contaminants to a new location on site or to an offsite treatment/disposal facility
Landfill	Results in placement of contaminants in a secure waste disposal facility, either on site or in a remote facility
Offsite Disposal	Transportation of contaminants to an approved, offsite disposal facility
Onsite Treatment	Involves anaerobic destruction of pesticide-contaminated soils in a specially-constructed plot on site
Ancillary Technologies	
Surface Water Diversion	
Sedimentation Control	
Backfilling	
Grading and Revegetation	

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*Required construction to complement the above major remedial actions.

The NCP 40 CFR 300.68 (f)(1) specifies five categories of site remediation as defined below:

Category	Description
I	No Action Alternative
II	Some minor construction and/or sampling and testing of the environment may be accomplished under this alternative.
III	Alternatives which reduce and/or mitigate the receptors' risk of exposure to the contaminants but do not fully comply with all environmental and public health standards.
IV	Alternatives which exceed applicable and relevant Federal public health and environmental standards.
V	Alternatives which provide treatment of the waste and reduce its toxicity or which remove the contaminating materials to an approved, offsite facility.

Remedial action alternatives were developed to provide a solution consistent with the site remediation categories identified above, as appropriate, for the Leetown Pesticide Site.

N. Description of Remedial Action Alternatives

Remedial alternatives have been developed to address the three source areas at the Leetown Pesticide Site that have been determined to be candidates for remedial action, on the basis of both extent of contamination and public health and environmental risk assessment. These source areas are as follows:

- Former Pesticide Pile Area (Pesticide Pile)
- Former Jefferson Orchard Pesticide Mixing Area (Pesticide Mixing Area)
- Former Crimm Orchard Packing Shed (Packing Shed)

Due to the proximity of the Pesticide Pile Area and the Pesticide Mixing Area, these two source areas have been considered as a single source. Consistent treatment of these areas as a single source also permitted parallel development of alternatives, which greatly facilitated comparison between alternatives.

Because of its spatial distinction from the first two source areas and the small quantities of contaminated soils present, the packing shed has been consistently treated separately in development of alternatives. However, in order to make optimal use of facilities proposed in conjunction with the alternatives incorporating onsite treatment landfilling, and because of the minimal quantities of material involved at the packing shed, and the comparatively high unit costs of constructing a treatment cell or landfill at the packing shed, a separate treatment cell and/or landfill has not been proposed for this area. Rather, it has been assumed that contaminated soils from the packing shed could be accommondated if such facilities are constructed for contaminant sources on the Robinson property.

Coincident with the remedial action alternatives developed in this section, the pesticide materials and associated contaminated materials presently located in the former Crimm Orchard packing shed will be removed. This action is defined in the FS but is not affiliated with any specific alternative. It is assumed that these materials will be removed under all alternative remedial actions except No Action (Alternative Nos. 1 and 2).

Approximately 15 drums and a small quantity of powdered pesticides have been identified at the packing shed. These materials, as well as a spray wagon and any contaminated flooring, will be removed for offsite disposal, at the discretion of the EPA. In order to compute costs, it has been assumed that all contaminated materials can be removed in one operation, requiring a maximum of 3 trucks. Access to Route 15 will be either via the Edwards or Stutler farm lanes, or across the Tabb cornfield to the southwest of the shed. All material will be transported in accordance with RCRA, U.S. Department of Transportation (DOT) regulations, and offsite treatment/disposal will be in conformance with the EPA Offsite Disposal Policy (EPA, December 5, 1985).

N-1. Remedial Action Alternative No. 1 - No Action:

The NCP requires that the FS develop and consider the No Action alternative as a point of comparison with remedial action alternatives. This alternative will entail no construction activity to remediate site conditions. The contaminated soils would remain in their present state. Removal of pesticides and contaminated debris and structural members of the packing shed would not occur.

Under this alternative, the risks to the public health and environment would remain unchanged.

N-2. Remedial Action Alternative No. 2 - No Action with Monitoring:

Alternative No. 2 is a modification of the No Action alternative to include environmental monitoring. As with Alternative No. 1, no construction would occur, and the risk to the public health and to the environment would remain unchanged. However, a program would be instituted to monitor any changes in conditions at the source areas and in the environment in their immediate vicinities that may have an effect on risk. Since the contaminants of concern are persistent pesticides that have low mobility by virtue of their comparative insolubility in aqueous media, little change in contaminant concentrations would be anticipated. For this reason, annual monitoring is considered adequate. Discretionary sampling may be required in the aftermath of significant rainfall events, given the proximity of the pesticide pile and pesticide mixing areas to watercourses.

N-3. Remedial Action Alternative No. 3 - Soil Cap:

This alternative fulfills Category II of the requisite levels of site remediation, as defined in the NCP 40 CFR 300.68 (f)(1)(iv). Although placement of a soil cap over the contaminated soils will reduce the opportunity for generation of contaminated dusts, it may not fulfill all of the Federal regulations (e.g., RCRA) regarding the disposal of hazardous substances.

Contaminated soils from the Pesticide Pile and the Mixing Areas would be consolidated to reduce surface area and enhance the cost effectiveness of the cap construction. Because greater volumes of contaminated soils are present at the pile area, location of the capped deposit in its vicinity would be most appropriate. Figure 14 provides a conceptual drawing showing a potential configuration for the capped deposit and a typical section showing cap construction.

The cap would consist of 18 inches of soil fill with an overlying topsoil depth of 6 inches to permit effctive establishment of vegetation. The plan layout would require about 40,000 square feet, with the contaminated soils placed to an average depth of about 6 feet. Such an area would provide storage for approximately 3,500 cubic yards of contaminated soil. Cap construction should require approximately 2,220 cubic yards of soil fill and 740 cubic yards of topsoil.

Approximately 2,580 cubic yards of contaminated soil are anticipated from the pesticide pile area and about 890 cubic yards from the pesticide mixing area. These volumes assume excavation to a depth of 6 inches for areas of 3 and 1 acre at the pesticide pile and mixing areas, respectively.

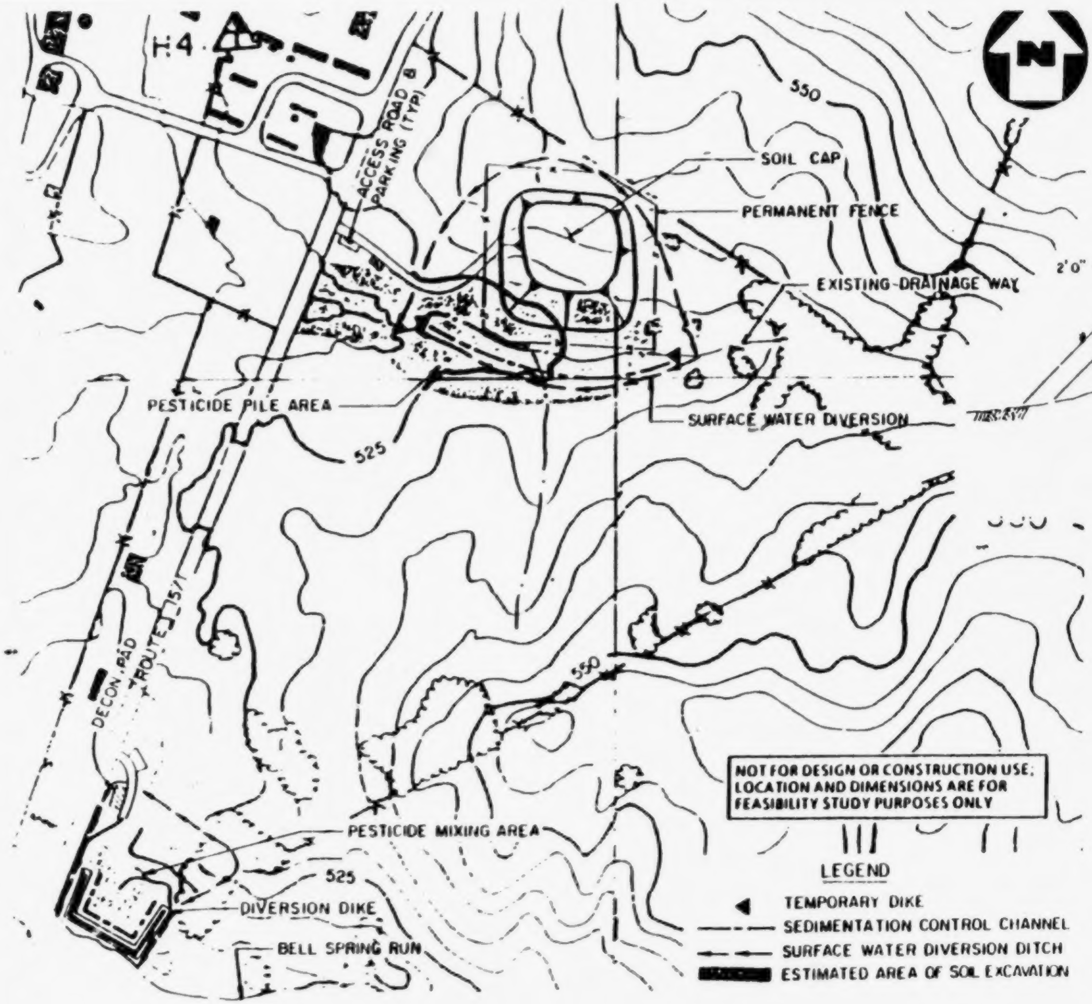
For this alternative ancillary construction would be necessary to support the construction action: This construction includes:

- access roads
- parking lot
- decontamination pads
- surface water diversion channel
- runoff diversion channel
- sedimentation channel
- diversion dike
- site restoration

N-4. Remedial Action Alternative No. 4 - Multi-media Cap:

The installation of a multi-media cap, rather than a cap of local soil, will satisfy the requirements of the Resource Conservation and Recovery Act (RCRA) for the closure of a waste area as a land disposal unit. In this manner, this alternative will meet the requirements of Category III of the requisite levels of remedial action.

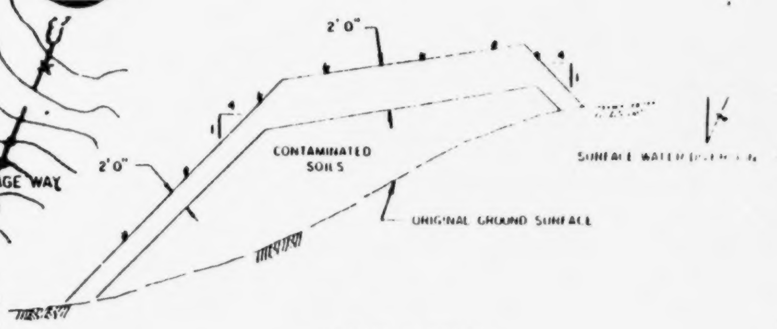
The intent of this alternative is identical to that of Alternative No.3. The lower permeability of the capping materials (clay and synthetic membrane) will further reduce surface water infiltration. This reduction may not result in significant additional benefit, however, since the


550
SOIL CAP
PERMANENT FENCE
EXISTING-DRAINAGE WAY
SURFACE WATER DIVERSION
ACCESS ROAD & PARKING (TYP)
PESTICIDE PILE AREA
525
550
ROUTE 1/5/1
DECON. PAD
PESTICIDE MIXING AREA
525
DIVERSION DIKE
BELL SPRING RUN
H4
N

NOT FOR DESIGN OR CONSTRUCTION USE; LOCATION AND DIMENSIONS ARE FOR FEASIBILITY STUDY PURPOSES ONLY

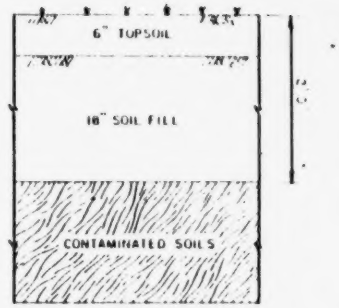
LEGEND

- ◀ TEMPORARY DIKE
- SEDIMENTATION CONTROL CHANNEL
- SURFACE WATER DIVERSION DITCH
- ▬ ESTIMATED AREA OF SOIL EXCAVATION


2'0"
2'0"
CONTAMINATED SOILS
ORIGINAL GROUND SURFACE
SURFACE WATER DIVERSION

TYPICAL SECTION

SOIL CAPPED DEPOSITS
NOT TO SCALE


6" TOPSOIL
18" SOIL FILL
CONTAMINATED SOILS
2'0"

SOIL CAP SECTION
NOT TO SCALE

SOIL CAP ALTERNATIVE 3A
LEETOWN PESTICIDE SITE, LEETOWN, WV

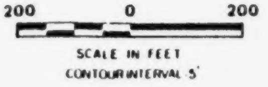

200
0
200
SCALE IN FEET
CONTOUR INTERVAL 5'

Figure 14

contaminants of concern are not readily soluble in aqueous media.

The cap would consist of a 24-inch layer of impervious clay, a 4-inch sand cushion, a 30-mil impervious membrance, an infiltration conducting zone of gravel 12 inches in thickness, filter fabric, an 18-inch layer of

soil fill, and 6 inches of overlying topsoil. In total, the thickness of the cap will be slightly in excess of 5 feet.

Wastes at the pesticide pile and mixing areas would be excavated and consolidated in a single area as before, with installation of a multi-media cap over this deposit. The potential for contaminant migration via wind or water erosion would be mitigated and the exposure pathway of concern would thus be disrupted. As with Alternative No. 3, the capped deposit would remove a portion of the area on the Robinson property from future agricultural use, but consolidation of the wastes from the property into a single, capped deposit would minimize the surface area involved, as well as the attendant cost for cap construction.

Figure 15 provides a conceptual design of the capped deposit area and multi-media cap, with typical sections to show the cap design. This cap will provide storage capacity for about 3,570 cubic yards of contaminated soils at an average depth of 6 feet. The site preparation and construction requirements at the pesticide pile area are identical to those specified for Alternative No. 3 and are not repeated in detail here.

The contents of the packing shed will be handled as specified in Section N. As proposed in Alternative No. 3 this alternative proposes consolidation of the contaminated soils to an area immediately east of the shed area. By so doing the cost of capping can be greatly reduced, since less surface area will be involved. In addition, it would not be practical to construct the multi-media cap on in-place soils in view of the constraints of the existing structure overlying the soils. Figure 16 provides a plan view of the proposed alternative as well as a typical section of the multi-media cap.

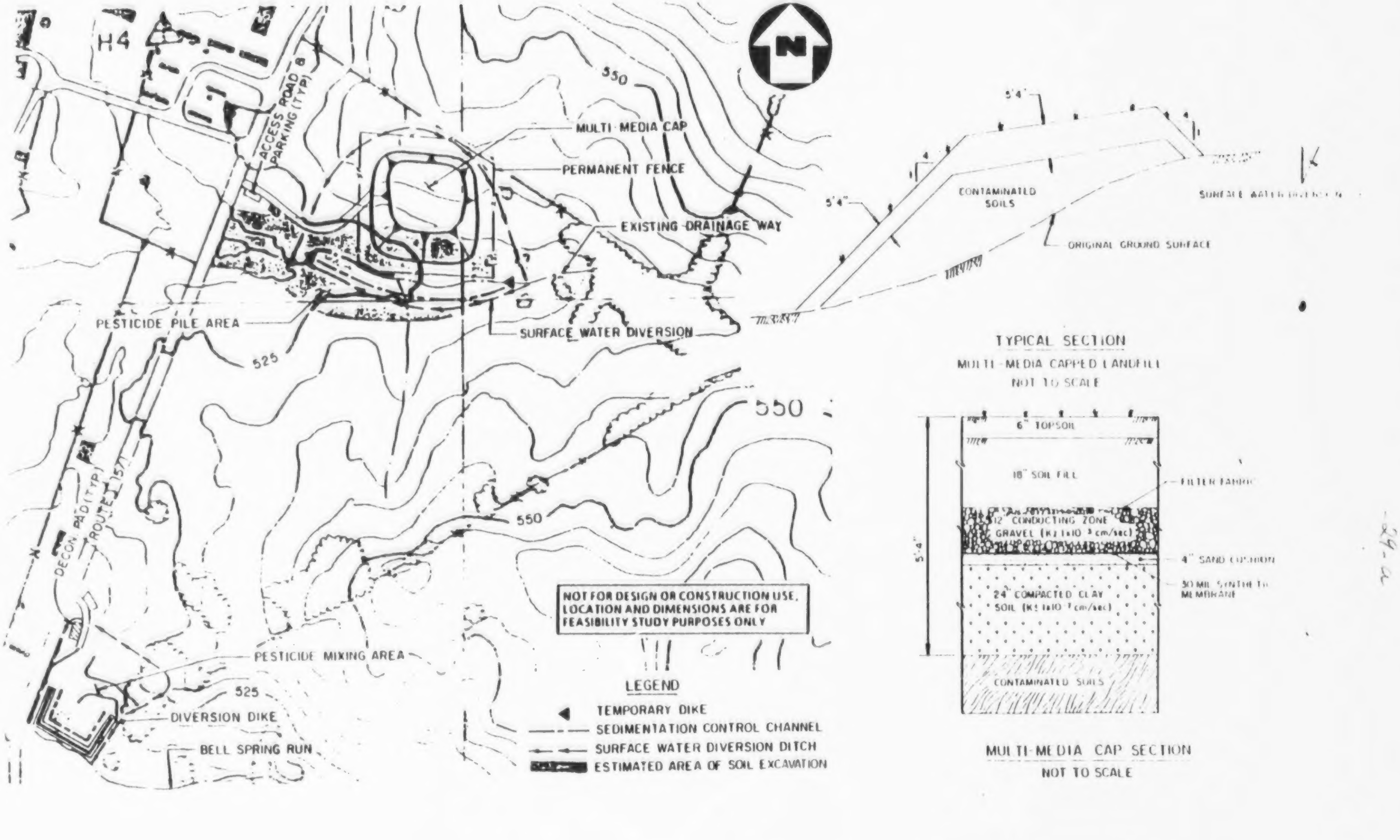
N-5. Remedial Action Alternative No. 5 - Onsite Landfill:

This alternative provides for the disposal of the contaminated soils from all three areas in an onsite landfill. The optimal location for the landfill would be close to the pesticide pile area on the Robinson property because of the greater volume of contaminated soils in this area. It would not be cost effective to construct an onsite landfill on the Tabb property for the 28 cubic yards of contaminated soils to be excavated from beneath the shed.

This alternative would comply with the requirements of Remedial Action Category No. IV, exceeding Federal requirements for waste disposal. This is true since compliance with the WVDNR requirement for 3 feet of compacted clay at the base of the capped deposit exceeds Federal guidelines.

Excavation of contaminated soils at both the pesticide pile area and the pesticide mixing area will require the construction of the same system

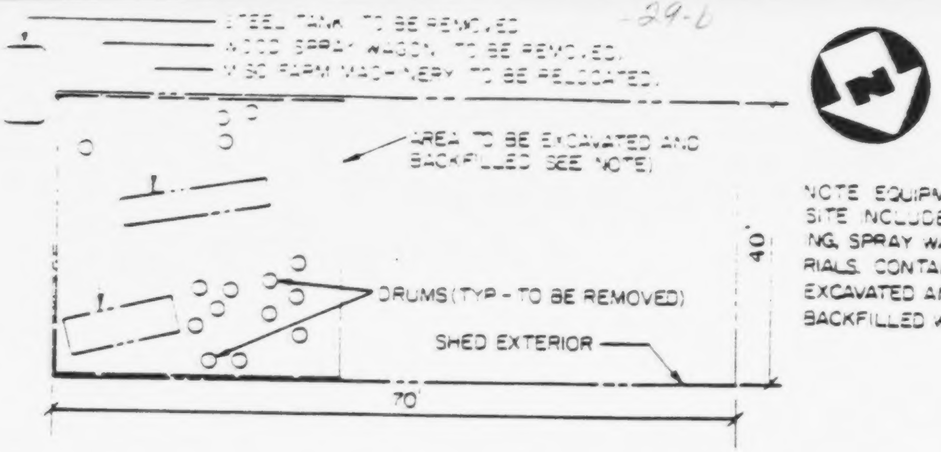
site.


H4
ACCESS ROAD & PARKING (TYP)
550
MULTI-MEDIA CAP
PERMANENT FENCE
EXISTING DRAINAGE WAY
SURFACE WATER DIVERSION
PESTICIDE PILE AREA
525
550
550
DECON. PAD (TYP)
ROUTE 1 15/1
PESTICIDE MIXING AREA
525
DIVERSION DIKE
BELL SPRING RUN
NOT FOR DESIGN OR CONSTRUCTION USE. LOCATION AND DIMENSIONS ARE FOR FEASIBILITY STUDY PURPOSES ONLY
LEGEND
TEMPORARY DIKE
SEDIMENTATION CONTROL CHANNEL
SURFACE WATER DIVERSION DITCH
ESTIMATED AREA OF SOIL EXCAVATION
5'4"
5'4"
4
1
4
1
CONTAMINATED SOILS
ORIGINAL GROUND SURFACE
SURFACE WATER DIVERSION
TYPICAL SECTION
MULTI-MEDIA CAPPED LANDFILL
NOT TO SCALE
6" TOPSOIL
18" SOIL FILL
FILTER FABRIC
12" CONDUCTING ZONE GRAVEL (K≥1x10⁻³ cm/sec)
4" SAND CUSHION
30 MIL SYNTHETIC MEMBRANE
24" COMPACTED CLAY SOIL (K≤1x10⁻⁷ cm/sec)
CONTAMINATED SOILS
5'4"
MULTI-MEDIA CAP SECTION
NOT TO SCALE
200
0
200
SCALE IN FEET
CONTOUR INTERVAL 5'

MULTI-MEDIA CAP ALTERNATIVE 4A
LEETOWN PESTICIDE SITE, LEETOWN, WV

Figure 15

-29-b


STEEL TANK TO BE REMOVED
WOOD SPRAY WAGON TO BE REMOVED
MISC FARM MACHINERY TO BE RELOCATED
AREA TO BE EXCAVATED AND BACKFILLED (SEE NOTE)
DRUMS (TYP - TO BE REMOVED)
SHED EXTERIOR
40'
70'
N

NOTE EQUIPMENT TO BE REMOVE
SITE INCLUDES TANK, DRUMS, F
NG, SPRAY WAGON, AND BAGGED
RIALS. CONTAMINATED SOILS TO
EXCAVATED AND AFFECTED AREA
BACKFILLED WITH APPROVED MAT

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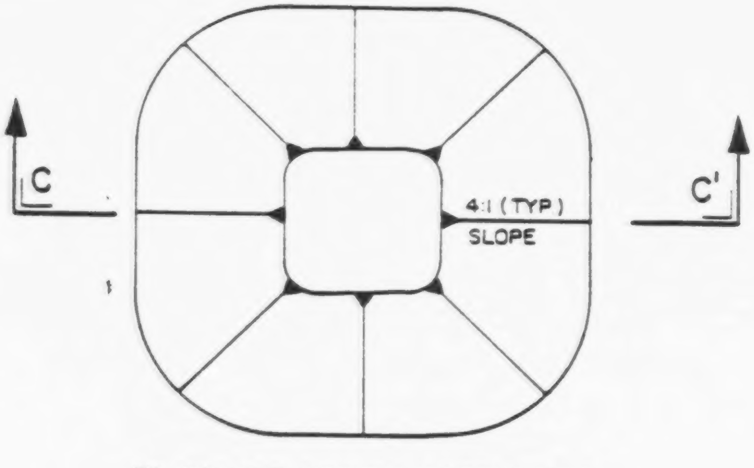
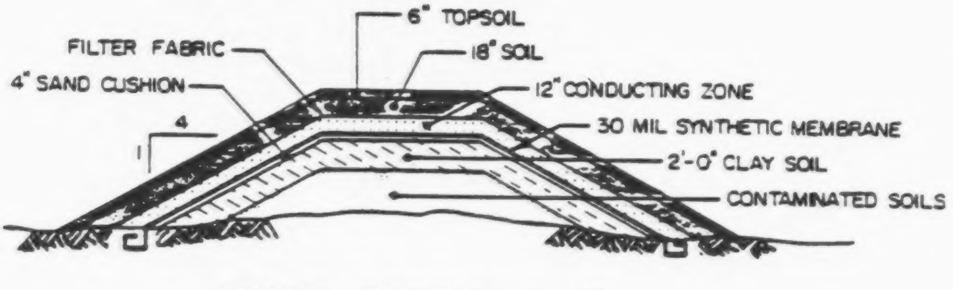
PLAN OF PACKING SHED


C
C'
4:1 (TYP)
SLOPE

PLAN OF MULTI-MEDIA CAP


6" TOPSOIL
FILTER FABRIC
18" SOIL
4" SAND CUSHION
12" CONDUCTING ZONE
4
1
30 MIL SYNTHETIC MEMBRANE
2'-0" CLAY SOIL
CONTAMINATED SOILS

CROSS SECTION C-C'

MULTI-MEDIA CAP ALTERNATIVE 4B
LEETOWN PESTICIDE SITE, LEETOWN, WV

NOT TO SCALE

Figure 16

of access roads, parking areas, decontamination pads and surface water controls as specified for Alternative No. 3. A total of 3,780 cubic yards of contaminated soils a gravel from the source areas will be accommodated by the landfill is between the two source areas, the following additonal construction will be required to avoid the need to use Route 15/1 to brind contaminated soils from the pesticide mixing area to the landfill site. .

- Access road - 1,100 ft x 15 ft
- Sedimentation channel - 2,370 cu yd
- Upgradient surface water diversion - 1,550 cu yd

These facilities have been shown in plan view on Figure 17.

Reclamation of excavation at both the pesticide pile area and the pesticide mixing areas is identical to that identified for Alternative No. 4 and is incorporated in the description of the current alternative by reference. Pesticide materials, flooring, and the spray wagon at the packing shed would be transported offsite for disposal as noted in Section N.

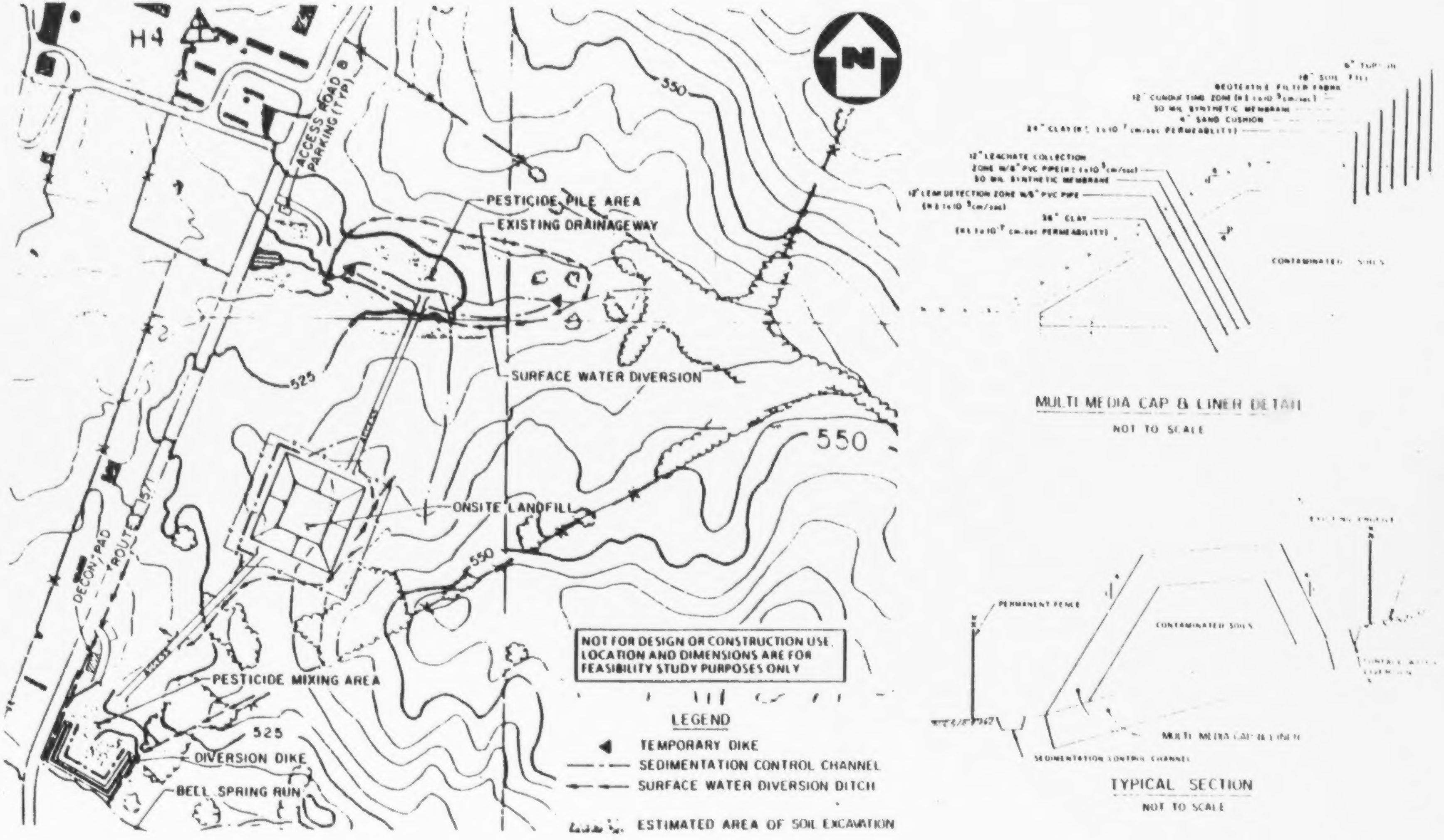
N-6. Remedial Alternative No. 6 - Offsite Disposal:

This alternative has been proposed to fulfill the requirements of Category V of the requisite levels of remedial action (offsite disposal). Offsite disposal provides a high degree of site remediation because it removes the contaminated soils to an approved, secure, hazardous waste disposal facility. In accordance with the EPA Offsite Disposal Policy (EPA, December 5, 1985), the option of treating the contaminated soils via offsite incineration has been proposed in conjunction with removal of the wastes to a disposal facility.

Incineration of the wastes was eliminated in the initial screening of remedial technologies on the basis of cost, primarily because of the low heat value of the contaminated soils. However, if treatment of the soils is required prior to disposal, incineration is the only logical, commercially available option.

By removing the wastes from the site, the potential for generation of dust emissions contaminated with pesticides will be mitigated to the extent that contaminated materials have been removed from the sites.

Contaminated soils at both the pesticide pile area and the pesticide mixing area would be excavated and transported to an offsite disposal area, with or without offsite treatment prior to disposal. The necessary construction (i.e., access road, parking area, decontamination pad, and surface water controls) to support excavation at these two sites and site restoration requirements do not differ from that specified in Alternative No. 3.


H4
ACCESS ROAD B
PARKING (TYP)
550
PESTICIDE PILE AREA
EXISTING DRAINAGEWAY
525
SURFACE WATER DIVERSION
550
ONSITE LANDFILL
550
ROUTE 1/5
DECON PAD
PESTICIDE MIXING AREA
525
DIVERSION DIKE
BELL SPRING RUN
NOT FOR DESIGN OR CONSTRUCTION USE. LOCATION AND DIMENSIONS ARE FOR FEASIBILITY STUDY PURPOSES ONLY
LEGEND
◀ TEMPORARY DIKE
SEDIMENTATION CONTROL CHANNEL
SURFACE WATER DIVERSION DITCH
ESTIMATED AREA OF SOIL EXCAVATION
6" TOPSOIL
18" SOIL FILL
GEOTEXTILE FILTER FABRIC
12" CONDUCTING ZONE (K ≥ 1x10⁻³ cm/sec)
30 MIL SYNTHETIC MEMBRANE
4" SAND CUSHION
24" CLAY (K ≤ 1x10⁻⁷ cm/sec PERMEABILITY)
12" LEACHATE COLLECTION ZONE W/8" PVC PIPE (K ≥ 1x10⁻³ cm/sec)
30 MIL SYNTHETIC MEMBRANE
12" LEAK DETECTION ZONE W/8" PVC PIPE (K ≥ 1x10⁻³ cm/sec)
36" CLAY (K ≤ 1x10⁻⁷ cm/sec PERMEABILITY)
CONTAMINATED SOILS
MULTI MEDIA CAP & LINER DETAIL
NOT TO SCALE
PERMANENT FENCE
CONTAMINATED SOILS
EXISTING GROUND
SURFACE WATER DIVERSION
MULTI MEDIA CAP & LINER
SEDIMENTATION CONTROL CHANNEL
TYPICAL SECTION
NOT TO SCALE

ONSITE LANDFILL ALTERNATIVE 5
LEETOWN PESTICIDE SITE, LEETOWN, WV

200 0 200
SCALE IN FEET
CONTOUR INTERVAL 5'

Figure 17

The estimated volume of contaminated soils to be excavated from the two sites is 3,470 cubic yards. In addition, contaminated gravel from the decontamination pads and a portion of the access road would require offsite disposal, bringing the total volume of material to about 3,580 cubic yards. Assuming haulage truck capacity to be about 13 cubic yards in order to achieve a total loaded gross vehicle weight of 32.5 tons to remain within haulage limits on secondary roadways, a total of 260 truckloads would be required in order to remove the materials. For the purpose of cost development in this FS, it was also assumed that these soils would be transported to a disposal site approximately 420 miles from the Leetown Pesticide Site. Transport would be by licensed haulers in conformance with regulations of the U.S. Department of Transportation (DOT) and also in accordance with the EPA Offsite Disposal Policy (EPA, December 5, 1985). An option for treatment of soil prior to disposal has also been included.

Figure 18 provides a plan view of areas to be excavated from the pesticide pile and mixing areas. Ancillary construction has also been shown. In conjunction with this alternative, contaminated soils from beneath the packing shed would be excavated and transported offsite for disposal, with or without prior treatment. Necessary supporting construction activities (i.e., improvement of haulage routes, and surface water controls) and site restoration requirements do not differ from those specified for Alternative 5 for this area.

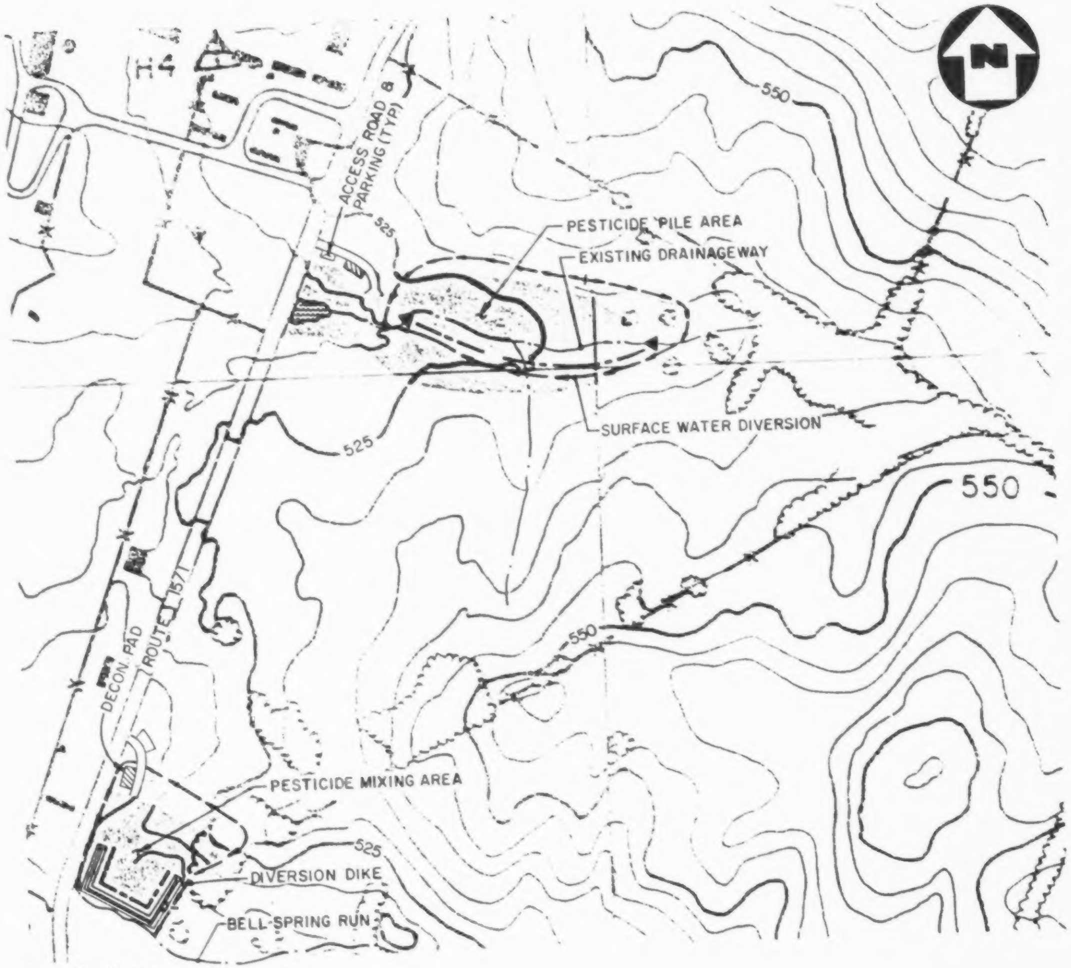
An anticipated 28 cubic yards of contaminated soils will be excavated from this site. As noted in Section N removal of drummed and powdered pesticides, as well as contaminated flooring and timbers from the eastern portion of the packing shed, will be undertaken in conjunction with this remedial action.

N-7. Remedial Action Alternative 7 - Onsite Treatment:

This remedial action alternative incorporates an innovative technology for destruction of pesticide contamination in soils. This level of remediation would conform to Category V, as outlined in Section 3.1, for the pesticide contaminants. Destruction of the onsite contaminants (i.e., DDT and its metabolites) can be achieved by anaerobic biodegradation in specially prepared treatment plots.

Treatment and/or destruction of the wastes on site is desirable in that dedication of lands in the site vicinity for disposal of the wastes is temporary, no waste transport from the source areas is required, except for transport of two loads of soil from the packing shed to the Robinson property, and no hazardous waste disposal capacity at offsite locations is necessary.

As shown in Figure 19, a single treatment cell would be created on the Robinson property, in the general vicinity of the pesticide pile area. Construction activities would be very similar to those identified in Alternative 5 for the onsite landfill. The small quantity of contaminated soils at the packing shed (about 28 cubic yards) would be incorporated into the treatment cell with soils from the pesticide mixing area and the pesticide pile area (about 3,500 cubic yards). Some additional volume



H4
ACCESS ROAD & PARKING (TYP)
525
550
PESTICIDE PILE AREA
EXISTING DRAINAGEWAY
SURFACE WATER DIVERSION
525
550
550
ROUTE 1571
DECON. PAD
PESTICIDE MIXING AREA
525
DIVERSION DIKE
BELL-SPRING RUN
N

SOURCE FIG I-2

NOTE:

PESTICIDE CONTAMINATED SOILS TO BE EXCAVATED TO A DEPTH OF APPROXIMATELY 6 INCHES AND TRANSPORTED OFF SITE TO A PERMITTED LANDFILL. DISTURBED AREAS TO BE BACKFILLED WITH TOPSOIL, SEEDED, AND MULCHED.

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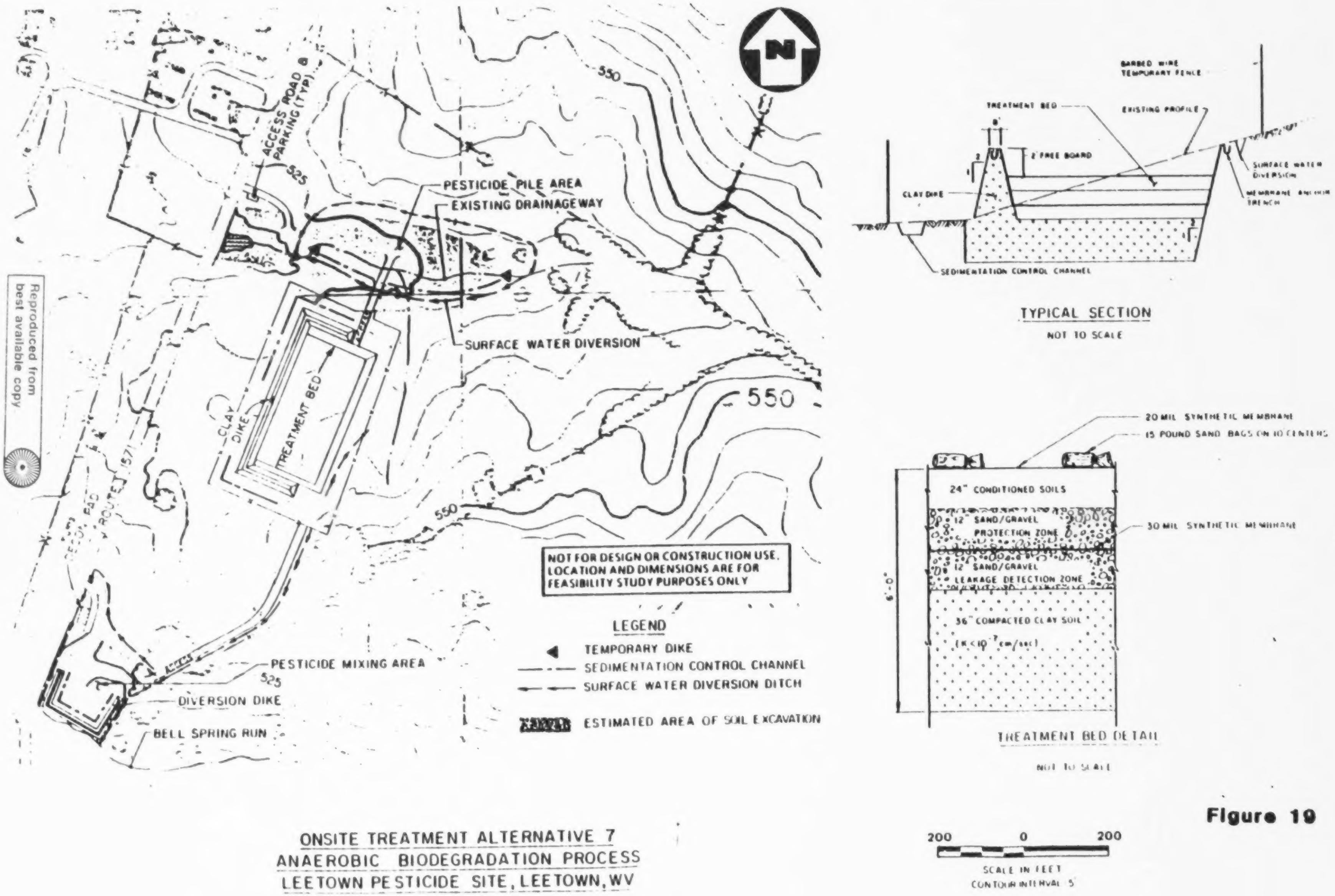
LEGEND

◀ TEMPORARY DIKE
—·— SEDIMENTATION CONTROL CHANNEL
—◀— SURFACE WATER DIVERSION DITCH
▨ ESTIMATED AREA OF SOIL EXCAVATION

200 0 200
SCALE IN FEET
CONTOUR INTERVAL: 5'

Figure 18

OFFSITE DISPOSAL ALTERNATIVE 6
LEETOWN PESTICIDE SITE, LEETOWN, WV


N
550
550
550
525
525
ACCESS ROAD & PARKING (TYP)
PESTICIDE PILE AREA
EXISTING DRAINAGEWAY
SURFACE WATER DIVERSION
CLAY DIKE
TREATMENT BED
ROUTE 1571
PESTICIDE MIXING AREA
DIVERSION DIKE
BELL SPRING RUN
NOT FOR DESIGN OR CONSTRUCTION USE. LOCATION AND DIMENSIONS ARE FOR FEASIBILITY STUDY PURPOSES ONLY
LEGEND
◀ TEMPORARY DIKE
SEDIMENTATION CONTROL CHANNEL
SURFACE WATER DIVERSION DITCH
▨ ESTIMATED AREA OF SOIL EXCAVATION
BARBED WIRE TEMPORARY FENCE
TREATMENT BED
EXISTING PROFILE
8'
2
1
2' FREE BOARD
CLAY DIKE
SURFACE WATER DIVERSION
MEMBRANE ANCHOR TRENCH
SEDIMENTATION CONTROL CHANNEL
TYPICAL SECTION
NOT TO SCALE
20 MIL SYNTHETIC MEMBRANE
15 POUND SAND BAGS ON 10 CENTERS
24" CONDITIONED SOILS
12" SAND/GRAVEL PROTECTION ZONE
30 MIL SYNTHETIC MEMBRANE
12" SAND/GRAVEL LEAKAGE DETECTION ZONE
36" COMPACTED CLAY SOIL
(K<10⁻⁷ cm/sec)
6'-0"
TREATMENT BED DETAIL
NOT TO SCALE
200 0 200
SCALE IN FEET
CONTOUR INTERVAL 5'

ONSITE TREATMENT ALTERNATIVE 7
ANAEROBIC BIODEGRADATION PROCESS
LEETOWN PESTICIDE SITE, LEETOWN, WV

Figure 19

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would be required for contaminated portions of access roads and decontamination pads.

The central treatment cell will consist of a clay bed, constructed on a graded area. Organic nutrients will be added to the contaminated soils in the cell to enhance rapid exhaustion of available oxygen via oxidation. The mixture will then be saturated with water, and covered with a membrane to maintain saturation and retard oxygen penetration into the cell. The degradation of contaminants will be monitored periodically during the treatment process to define the endpoint. Since this is a passive treatment process, there will be minimal attendant operation and maintenance costs.

Ancillary construction at each of the three areas, as well as restoration requirements for the excavated and disturbed areas, are identical to those specified for Alternative 5 (Onsite Landfill).

O. Recommended Alternative

Section 300.68 (i) of the National Contingency Plan states that the appropriate extent of remedy shall be determined by the lead agency's selection of a remedial alternative which the agency determines is cost-effective and which effectively mitigates or minimizes damage to and provides adequate protection of the public health, welfare and environmental. In selecting a remedial alternative EPA considers all environmental laws that are applicable and relevant. Based on the evaluation of cost-effectiveness of each of the proposed alternatives, the comments received from the public, information from the Feasibility Study and information from the West Virginia Department of Natural Resources we recommend that Alternative No. 7 as described above, be implemented at the Leetown Pesticide Site.

This selected remedy will be designed to eliminate DDT and other pesticide contamination through onsite destruction of the chemicals by anaerobic biodegradation.

Destruction of these wastes onsite is a desirable alternative in that dedication of lands in the site vicinity for treatment of the wastes is temporary, waste transport from the source areas over public roads is limited (two truck loads of contaminated soil from the packing shed to the treatment bed will be needed) and no hazardous waste disposal capacity at an offsite RCRA facility will be necessary.

A single treatment cell would be constructed on the Robinson property in the vicinity of the pesticide pile area (Figure 19). This treatment cell will consist of a lined bed, constructed on a graded area. Organic nutrients will be added to the contaminated soils in the cell to enhance rapid exhaustion of available oxygen by oxidation. The mixture will be saturated with water, and covered with a membrane to maintain saturation and retard oxygen penetration into the cell. The degradation of contaminants will be monitored periodically during treatment to define the endpoint. In the pesticide pile area an access road will be required from Route 15/1 to the edge of the work area. This roadway will be 350 feet in length and 15 feet in width and will consist of a 12-inch layer of gravel.

A parking lot will be required with space for about 5 vehicles near Route 15/1. This area will also be surfaced with gravel.

A decontamination pad will be required to decontaminate all vehicles exiting the area. This pad will consist of a 12-inch gravel layer with a 30-mil membrane underlayment and will be situated near the edge of the working area. Its dimensions will be approximately 20 feet by 40 feet. Decontamination wash will be collected and will be transported offsite for treatment and disposal in accordance with the EPA offsite disposal policy. The pad itself will be disposed in the capped deposit during site restoration.

It will also be necessary to construct an upgradient surface water diversion channel to control surface water runoff from entering the work area. Construction of this channel is anticipated to involve excavation of 295 cubic yards of soil.

A diversion channel will be required to divert runoff that would normally flow in the natural drainage adjacent to the pile area during the period necessary to excavate contaminated sediments from the drainage. Construction of this channel is anticipated to require excavation of about 3,330 cubic yards of soil. In addition, an 18-inch layer of rock (1,210 cubic yards) will be required to stabilize the channel to discourage flooding during significant rainfall events. The stone protection will provide immediate erosion control.

A sedimentation channel will be created by excavating about 1,650 cubic yards of soil between the capped area and the diverted stream to collect runoff and provide for retention of suspended sediments during the course of the excavation. The sedimentation channel will provide adequate detention storage and sediment volume for the 25-year design storm, in accordance with Federal hazardous waste landfill regulations (RCRA).

Restoration of the excavation at the pesticide pile area will require approximately 2,220 cubic yards of topsoil and backfill soil to achieve proper grades and reestablish positive site drainage. Approximately 170,700 square feet (4 acres) of surface area will require revegetation at this site.

For the pesticide mixing area supporting construction activities under this alternative are similar to those specified for the pesticide pile area. These include an access road from Route 15/1 with parking facilities, a decontamination pad, and surface water controls, as noted below:

- Access road - approximately 100 ft x 15 ft
- Parking area - 1,250 sq feet
- Decontamination pad - 800 sq ft
- Surface water diversion (encircling the work area to intercept run-on) Excavation of approximately 250 cubic yards of soil will be required.

° Diversion dike and sediment control

A dike of about 250 ft in length will be constructed along Bell Spring Run and will continue along the eastern and western ends of the work area. Approximately 520 cubic yards of soil fill will be required. The purpose of this dike will be to prevent flooding of the work area from Bell Spring Run during the excavation of contaminated soils. A sedimentation channel will be constructed within the dike to capture any sediments eroded from the work area during construction.

Restoration of the site will involve placement of a graded fill of about 820 cubic yards, surfaced with about the same quantity of topsoil to provide a medium for revegetation. A total area of about 40,000 square feet (1 acre) will require revegetation.

Removal of pesticide product, contaminated flooring, and a wooden spray wagon will be undertaken for the Crimm Orchard Packing Shed. Incineration of the pesticide product is the preferred disposal method.

Contaminated soils underlying the shed area at this site have been found to contain approximately 22,000 ppb of DDT and its metabolites. In conjunction with this alternative, a soil cover with a gravel surface is proposed to be installed with minor consolidation of contaminated soils. This alternative will require about 100 cubic yards of local, clay soils and about 35 cubic yards of coarse gravel.

Access to the site for construction equipment will be either from the Edwards farm lane, across the Tabb cornfield to the west of the shed to the Stutler farm lane, or across the Tabb cornfield to Route 15. Use of either of the farm lanes may require minor improvements to permit access by construction equipment.

Because of the position of the shed on a topographic high point, no surface water run-on and minimal surface water runoff is anticipated. The vegetated areas lying between the shed and Bell Spring Run should effectively preclude any sediment that may be eroded from the area around the shed during construction from entering the stream. As additional protection, however, excavation of a sediment channel (blind trench) is proposed, involving approximately 20 cubic yards of soil. This trench would be placed along the northern periphery of the work area, between Bell Spring Run and the work site.

A temporary decontamination facility will be provided and all equipment will be decontaminated prior to leaving the shed area. Decontamination wash will be collected and transported off site for appropriate treatment and disposal.

P. Contaminant Reduction Target Levels

The average target soil concentration for DDT and its metabolites for all soils placed in the treatment bed is 300 ug/kg or parts per billion. This concentration is required to reach a 10^{-5} carcinogenic risk for inhalation based on the exposure scenario described in Section K-

K-3 of this document (Quantitative Risks). This target concentration is much lower than would be required for dermal contact (3,400 ug/kg) primarily bacause of the greater adsorption of these compounds through the lungs and the gastrointestinal tract then through the skin. Meeting the 10^{-5} inhalation risk would be equivalent to the 10^{-6} carcinogenic risk for dermal contact. The action levels set for contamination reduction are less than the background levels found in the Leetown Orchard areas.

The risks associated with Leetown's orchards under the exposure scenerio, are somewhat greater than 10^{-5}, (actual average risk 8.2×10^{-5}), therefore our target level will reduce the risks to a point greater than background levels.

This alternative will not remediate arsenic or lead contaminant levels found in the soils of the three remedial action areas. The levels of arsenic and lead in these areas are statistically comparable to typical average levels found in U.S. orchards.

Table 17 shows the levels of arsenic and lead detected in the areas of concern. This table shows that the arsenic and lead levels that are exhibited in the Robinson Property (non-disposal) areas are similar to those levels found in the pesticide pile area and the mixing area. However, the average concentration of arsenic and lead found in the orchards that are now the USF&W properties are somewhat lower. This is explained by the age of the orchard areas. The orchard that once occupied the Robinson Property area was older and more extensively used than the orchards that spread over what is now USF&W lands. Therefore, the accumulation of lead arsenate (a pesticide) is greater in this area. However, the risks associated with these concentrations of arsenic and lead are within the same order of magnitude from the old orchard to the new orchard (or from the Robinson Property to the USF&W Property). This is unlike the risks from DDT and its metabolites which was an order of magnitude higher risk level at the Robinson Property disposal areas than in the Orchard Background areas. Therefore it can be concluded that the arsenic and lead derived from historical lead arsenate spraying from agricultural activities and is somewhat consistant over the orchard areas. On the other hand the contrast of DDT levels and risks between the disposal areas and the orchard background areas indicates that this elevation in the disposal areas was caused by non-agricultural circumstances. For the pesticide pile the cause is indicative of the dumping incident while in the pesticide mixing areas (including the packing shed) the cause seems to be from historical sloppy housekeeping.

Q. Operation and Maintenance (O&M)

Operation and maintenance activities for this site will be very limited. All sampling to verify degradation of the treatment bed soils is considered part of the remedial action and will be fund financed until the remedy is considered complete. Upon reaching contaminant target levels and/or the remedy is officially completed, the treatment bed will be excavated and distributed over the area of land near the construction site (restricted to the Robinson Property). Subsequently this area will seeded for revegetation. All temporary ancillary construction will be removed at this time. These activities will also be considered part of the remedy and eligible for trust fund monies.

Table 17
Arsenic and Lead Levels
in Leetown Pesticide Study
(concentrations in ug/kg)

Location	As. Range	Avg. Concentr.	Detection Frequency	*Adjusted Average
Orchard background (USF&W Areas)	10-53	38	7/7	41
Orchard background (Robinson Property Area)	111-123	116	2/2	116
Mixing Area	23-110	62	3/3	62
Pesticide Pile Area	21-759	137	15/15	98

Location	Pb Range	Avg. Concentr.	Detection Frequency	Adjusted Average
Orchard background (USF&W Areas)	36-341	209	7/7	217
Orchard background (Robinson Property Area)	474-991	732	2/2	732
Mixing Area	104-328	199	3/3	199
Pesticide Pile Area	44-1,040	304	15/15	267

* Adjusted average obtained by eliminating the high and low sample concentration, where significant number of samples allow.

The EPA will then undertake operation and maintenance activities for a period of one year. These actions will consist of inspections and possible landscaping (if needed) of the seeded area to insure a proper and healthy vegetation growth and semi-annual groundwater sampling in the monitoring well network constructed around the treatment bed area. These samples should be analyzed for metals and pesticides only.

Due to the contaminant destruction capabilities of this process, and the adsorbing nature of the site contaminants to ambient soil, it is anticipated that state O&M activities will not last over two years (years 3 and 4 following remedy completion). These activities will consist of monitoring well sampling (semi-annually) for metals and pesticides and periodic inspections of the treatment area (Robinson Property) to monitor the vegetative cover. The costs for these actions have been estimated at $10,000 for the first year and $7,500 for the second. All O&M activity will be negotiated and approved in an executed State-Superfund Contract between EPA and the State of West Virginia for this site.

R. Compliance with Other Environmental Laws

R-1. General:

The remedial action alternative was evaluated in the context of site remediation in compliance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) which requires that Federal, state and local laws and regulations be considered.

Applicable Federal regulations include the following:

- Resource Consevation and Recovery Act (RCRA), CFR Title 40, Chapter 1, Parts 264 and 265
- Clean Water Act (CWA)
- Executive Order 11990-Wetlands Protection
- Executive Order 11998-Floodplain Protection
- Occupational Safety and Health Administration (OSHA) guidelines
- Department of Transportation (DOT) hazardous materials transportation regulations

State regulations applicable to hazardous and solid wastes and construction activities that may be applicable to the selected remedy found in the following sections of the West Virginia Administrative Rules:

- West Virginia Department of Natural Resources (WVDNR), Chapter 20-5E, "Hazardous Waste Management Regulations" (1985).
- Commissioner of Highways, Chapter 30-5E, "Transporation of Hazardous Wastes by Highway Transportation" (1985).
- WVDNR, Chapter 20-5F, "Legislative Regulations for Solid Waste Management" (1984).
- Surface Water Resources Branch, Chapter 20-5 and 20-5A, "Requirements Governing Water Quality Standards" (1983)

Based on a meeting with representatives of the Jefferson County Commissioners, Jefferson County Department of Health, and Jefferson County Planning Commission, it does not appear that Jefferson County has any regulations in addition to the state regulations governing the remedial action contemplated at the Leetown Pesticide Site.

R2. Resource Conservation and Recovery Act (RCRA):

The design, construction and operation of the proposed treatment bed in this option will meet substantive requirements of RCRA Part 264 Subpart K, Surface Impoundment Regulations and Subpart F, Groundwater Protection Regulations.

All work pertaining to the above regulations, or similar state standards, will be closely coordinated with the regulatory office within the State of West Virginia DNR and EPA's RCRA Branch when necessary.

R3. Wetlands/Floodplains Assessment:

With respect to environmental considerations, emphasis is placed upon whether the action to be taken will exert detrimental effects on environmental values. In particular, these concerns relate to impacts to sensitive habitats and unique species. In addition, the degree of physical alteration to the floodplain configuration must be considered. Federal legislation mandating evaluation of these issues may be found in Executive Order 11990 (Wetlands Protection) and 11988 (Floodplains), as well as in Appendix A to 40 CFR, Part 6, which contains a statement of procedures on floodplain management and wetlands protection as a adjunct to the National Environmental Policy Act (NEPA). The NEPA requires that all major Federal actions consider potential environmental impact in a formal assessment. However, actions at CERCLA sites were administratively excluded from the assessment procedures under NEPA, with the stipulation that the RI/FS process address environmental impacts in a manner that is "functionally equivalent" to the NEPA requirements.

A primary goal of the wetlands and floodplain legislation was to require Federal agencies to justify the need to undertake a specific construction activity within a wetland or floodplain, as opposed to in an adjacent area of lower environmental sensitivity. In the context of CERCLA actions at the Leetown Pesticide Site, a portion of the areas to be remediated already lie within the restricted zones, and the question actually becomes one of balancing whether short-term detriment associated with remedial construction activites within the floodplain or wetland will be offset by the long-term benefits gained via mitigation of a contaminant source.

With respect to the Leetown Pesticide Site, the pesticide mixing area lies within areas identified by the Federal Emergency Management Agency (FEMA) as components of the 100-year floodway of Bell Spring Run.

obviously, it is not possible to consider remedial action without undertaking construction activity within the floodway. The conceptual design for the selected remedial alternative has incorporated protection against potential flooding during construction, and has also proposed means of surface water control to prevent or mitigate excessive sedimenta of the receiving streams as a result of earth-moving activities.

The ultimate location of the onsite treatment bed is proposed to be well beyond the limits of the 100-year floodway, and restoration of the excavated areas within the floodways has been proposed to establish a surface topography that will be consistent with site drainage patterns and will not pose any future impacts to the floodway.

EPA's NEPA Compliance Section has established that two of the three remedial sites are located within wetlands. These areas are the mixing area and the pesticide pile area. The wetland is the Bell Spring Run and tributary floodplains.

Because of the selected remedial action will take place in this wetland, an assessment of these actions must be given in this document. The wetlands assessment consists of five requirements which must be addressed:

1) the reason why the action must be taken in a wetland
2) a description of significant facts considered in making this decision
3) a statement indicating whether the proposed action conforms to state wetland protection standards
4) a description of the steps taken to minimize harm to the wetlands, and
5) a description of how the action affects the values of the wetlands

The rationale for supporting wetland excavation to implement the remedial action is that it is necessary to remove contaminants from the soils/sediments in order to eliminate potential threats to the public health. With respect to this site, the two areas (of three) that are considered for remediation, already lie within the designated wetland area. It would not be possible to consider any type of remedial action without undertaking construction activities within that wetland. Therefore, except for a no-action alternative, taking action within the designated wetland is unavoidable.

Significant facts considered in making the decision to take remedial action have already been discussed in this document. Particular emphasis for action is placed in the Health and Environmental Impacts Section (Sections K-1f; K-1g; K-1h; K-2 and K-3) of this doucment.

Currently there are no specific State wetlands protection standards. In the absence of State regulations, EPA guidelines on wetland protection will be followed whenever and wherever applicable. Steps will be undertaken during design and implementation of this alternative to minimize the impact of construction activity on the wetlands. Ancillary construction structures needed for proper implementation of this alternative are temporary for the most part. The surface water diversion channel, that

Table 18

Impact of Remedial Action in Wetlands at Leetown Pesticide

Function/value	Effect	Impact
Hydrology	a. slight effect on flood control if pond is removed	0
	b. no impact to groundwater re/discharge due to karst terrain	0
	c. reduced shoreline anchoring by eliminating vegetation	-
Water Quality	a. Nutrients removed	-
	b. Toxicants removed	+
Food chain/ Nutrient cycles	a. primary producers removed	-
	b. decomposers/detritus removed	-
	c. nutrient export reduced	-
	d. secondary producers utilization reduced	-
	e. transport of toxicants in food chain removed	+
Habitat	a. substrate removed for benthic invertebrates	-
	b. roosting structure and forage species removed for birds	-
Socioeconomic	a. no impact to passive use	0

Many of these effects are only short term. Stream substrate and benthos should recover by one growing season via sedimentation and recruitment.

diverts natural flow away from proposed excavation areas near the pesticide pile area, will be permanent. This is mainly due to the fact that removing this structure at the end of construction acitivities may cause more of a sedimentation problem downstream that would be leaving it in place. Because this structure will be permanent consideration will be given to lining the bottom of this channel with a material that will facilitate revegetation by providing an artificial root system. Any roads that are slated to be constructed for this action will be designed to minimize the impact their construction would have on the wetland area. Only physical brush cleaning methods will be employed when needed, and any revegetation will be done with native wetland species, if possible. The actions proposed in the wetlands at this site have a greater positive magnitude of impact for those wetlands than negative impact. Existing contamination of pesticides will be destroyed and taken out of the biogeochemical cycle of the environment. Table 18 displays the impact different functions may have on the wetlands in question.

S. Evaluation of Alternatives Not Selected

The No Action alternative is required to be considered in the NCP as a baseline case. Under this alternative, no work will be performed to improve site conditions, and receptors within the study area will continue to be subject to existing conditions.

The NCP requires remedial action to be taken at CERCLA sites in order to "prevent or minimize the release of hazardous substances" so that they do not "migrate to cause substantial danger to present or future public health or welfare, or to the environment." Three source areas have been identified which exhibit contaminant levels substantially in excess of local or national background levels for agricultural or orchard areas. In addition, the potential exists for unacceptable health risks to local residents if these areas are brought under management for crop production with attendant tillage.

Therefore, the No Action alternative would leave contaminants on source areas in excess of normal background levels as well as in excess of those suggested by relevant environmental and public health guidelines.

In addition to soil erosion, any potential disturbance of the soil will release dust, resulting in both dermal and inhalational/ingestional exposures. There is no indication that this has occurred in the past or that it will occur in the future. However, the potential exists for changes in present land use at the source areas which would involve tillage of these soils.

Although casual intruders and trespassers are not viewed as receptors at this site, farm animals could regularly come into contact with the contaminated soils. Horses, and possibly dairy cattle, could graze on or near the source areas and thereby be exposed to pesticides in the soil or in the vegetation.

The most critical exposure pathway and subsequent health risk at th site is the inhalation of and dermal contact with contaminated soils during agricultural activities. Many of the pesticides detected in the soils, are known or suspected human carcinogens. Residual levels of pesticides in the orchard areas are typical of orchard areas throughout the United States. However, the pesticide pile, pesticide mixing area, and the packing shed exhibited levels of pesticides that were substantial in excess of the local agricultural or orchard levels.

In addition to this route of exposure, the potential for future groundwater contamination was evaluated in the RI. Detailed calculations were presented in the RI and are summarized herein. Theoretical leachate concentrations were developed for the maximum concentrations of 4,4'-DDT and toxaphene, based on soil/sediment adsorption coefficients. Travel time through the unsaturated zone and theoretical water table input concentrations were predicted using an unsaturated zone assessment model.

Results of this modeling indicated that approximately 250 years would elapse before the DDT reached the water table. However, the concentrations would be so low that ingestion of the actual percolate would result in a risk of 3.7×10^{-7} (or 1 additional case of cancer in an exposed population of 2.7 million people).

Arsenic remains bound to the soil particles and is not likely to move into the groundwater within the observed range of pH. Arsenic was not detected at concentrations in excess of the laboratory detection limit in any of the groundwater samples collected at this site.

It is evident that, even under worst-case conditions, there is little apparent potential for groundwater contamination at the Leetown Pesticide Site.

The generation of fugitive dust from the three source areas is not creating any significant risk at the present time. Under worst-case conditions, the greatest risk (4.4×10^{-8}) was presented by the pesticide pile.

No Action in the source areas will continue to expose farm animals grazing these areas or eating silage grown in these areas. It is difficult to quantify the risks to farm animals, but exposures could occur either through dermal contact or through ingestion of vegetation that has taken up pesticides. Human exposure via through this route is considered minimal.

For Alternative 2, No Action-Monitoring, would present the same potential public health risks as described in the No-Action option. However, a multi-media sampling program will be established for early detection of any migration of contaminants in the environment.

Alternative 3 involves capping the contaminants, after consolidation, with a soil cover. Since the state regulations for the disposal of hazardous substances are somewhat more stringent than the Federal RCRA standards, all state standards would not be fulfilled. Due, in part, to the presence of highly folded carbonate bedrock underlying the Robinson property, the project area does not meet all conditions for siting a permanent hazardous waste facility.

With respect to land use, the construction of a capped deposit would require a long-term reservation of land on the Robinson property, in order to protect the integrity of the cap system. Administrative constraints would be required regarding future use of this area.

Alternative 4 directs that a multi-media cap be constructed on the Robinson property over the consolidated contaminated soils. This alternative would include most of the design recommendations detailed inthe capping regulations under RCRA. As in Alternative 3 this option does not mee all conditions for siting a permanent hazardous waste facility. In addition administrative constraints on land use would be necessary for this option.

Alternative 5 describes construction of a permanent on-site landfill for disposal of the wastes in question. This landfill will meet all substantive requirements of RCRA for construction of hazardous waste landfills. This option, again, has the same restrictions as described in Alternatives 3 and 4.

Alternative 6 calls for off-site disposal of the contaminated material. This option was not chosen mainly bacause it is not the most environmentally secure option. The preferred option offers the destruction of contamination as opposed to this alternative which only transports the contaminated soils and material from one area to another. In addition, treatment through incineration was considered before disposal. This option is not the most cost-effective method of treating the contamination (the preferred option offers treatment for about $6 million less), therefore it was eliminated from consideration. An alternative Matrix which compares all categories of consideration between each alternative is found in Table 19.

T. Proposed Action

We request your approval of the recommended remedial alternative. The estimated base capital cost for this option is $1,014,000.

Operation and maintenance costs for the estimated required tow years are approximately $17,500. The base present-worth costs for design and implementation of the Onsite Treatment Alternative is $1,116,000.

Table 19
Alternatives Matrix
Leetown Pesticide Site

Alternative	Technical Feasibility	Environmental Concerns	Institutional Issues	Public Health Evaluations	Public Comments	Present Worth
1. No Action	Not Applicable.	Sedimentation loading to streams may increase contamination in stream sediments. Fish and benthic community may become more adversly affected. Even with no action there is little apparent potential for ground water contamination.	No Action circumuents NCP directive to prevent or minimize the future release of hazardous substances.	Contamination surface soils would remain source of potential health risks to individuals who may till or disturb the land in any manner. Farm animals who may graze on or near the source areas would be exposed to pesticides. Any utilization of these animals (milking/slaughter), may pass on contamination to humans.	No action was not endorsed by the local government or the local public.	$ 0
2. No Action With Monitoring	Env. monitoring of soils, sediment, surface water and ground water using established standard sampling methods. Pesticides and Inorganic metals analysis would be performed in accordance with standard methods.	Same as 1. However, any increase in stream contaminants would be detected and mitigative actions could be initiated.	Same as 1.	Same as 1.	No action with monitoring was not fully endorsed by the local government. The County Commissioners would prefer that EPA purchase the land and place a restriction on the property. The public did not comment on this alternative.	$227,000
3. Consolidate Contaminated Soils, Construct Soil Cap	All construction activities in this option are commonly performed by applicable contractors.	Excavation of soils would take place in riparian wetlands and within the 100 yr. flood plain. The impact to this area is short-term and measures to minimize damage will be undertaken. Trans-	Project area does not meet all RCRA siting conditions for a permanent hazardous waste facility. State regulations for disposal of hazardous substances would not be fully met.	Would eliminate public health threat if soil cap integrety is maintained.	No Comments.	$745,000

Alternative	Technical Feasibility	Environmental Concerns	Institutional Issues	Public Health Evaluations	Public Comments	Present Worth
3. Continuation		portation of packing shed material to offsite disposal may be of some concern if a release occurs during transport.	Long-term reservation of land at the construction site, by way of an institutional control, may be necessary to prevent loss of integrety to the cap system.			
4. Consolidate Contaminated Soils, Construct Multi-Media Cap	All planned activities are commonly performed and can be implemented by an experienced contractor.	Same as 3.	Although cap system incorporates all recommended technical design for a cap, the site still does not meet all conditions for a permanent hazardous waste facility. Long-term land restrictions to protect the cap integrety would need to be implemented for this option.	Same as 3.	No Comments.	$1,021,000
5. Constuction of Onsite Landfill	The required construction activities are feasible and can be implemented at the Robinson Property. Geologic rock outcrops may pose some difficulty during construction.	Same as 3 and 4.	Conceptual design meets State landfill construction standards. These standards exceed RCRA requirements. Institutional controls on land use would be necessary for this option. Siting requirements for this landfill remains an issue.	May result in more frequent exposure to site remediation workers. Would eliminate public health risks with land use controls.	No Comments.	$1,253,000
6A. Excavation with Offsite Disposal at Hazardous Waste Facility	Excavation and transport of contaminated soil is commonly performed and is implementable for this site.	Transport of contaminated material would take about 260 truck loads, totaling approx. 220,000 truck miles. This increase the chances of a vehicular mis-	All transportation performed by permitted transporters. The waste would only go to a permitted complying hazardous waste facility. Land use	Potential risk to public receptors from vehicular mishap during transport of wastes.	No Comments.	$1,965,000

Alternative	Technical Feasibility	Environmental Concerns	Institutional Issues	Public Health Evaluations	Public Comments	Present Worth
Continuation of 6A		contaminated soils into environment. This option would only transfer waste from one place to another.	be required for this option.			
6B Excavation with Offsite Incinceration of Soils	Some question on total destruction of pesticides due to low fuel value of the soils. Would not eliminate lead or arsenic in soil therefore residual ash may need to be transported to a hazardous waste facility.	Same as 6.	Any incinerator used would need to be RCRA permitted. Land use controls would be unnecessary.	Same as 6.	High Cost of this option did not meet with public approval.	$7,314,000
7. Onsite Treatment of Soils Through Anaerobic Biodegradation	Biological degradation has been used to destroy DDT and other pesticides for many years. Treatment is a known and accepted method for contaminant destruction. Field test and bench scale studies would be necessary for proper implementation.	Only concerns for this option would be limited waste materials transport from packing shed area. Would permanently destroy contaminants therefore removing them from the biogeochemical environment. Concerns involving wetlands and floodplains also apply to this option.	Treatment cell would meet all substantive requirements of the RCRA surface impoundment regulations. Land use controls would only be necessary for the time it takes to degrade the contaminants. (Estimated 1-2 yrs)	Would eliminate public health threat upon completion of remedy.	This option was favored by attendees of the public meeting.	$1,116,000

RESPONSIVENESS SUMMARY

LEETOWN PESTICIDE SITE
JEFFERSON COUNTY, WEST VIRGINIA

MARCH 1986

This community relations responsiveness summary is divided into the following sections:

Section I: Overview - A discussion of the EPA's preferred remedial action alternative and anticipated public reaction to this alternative.

Section II: Background of Community Involvement and Concerns - A brief history of the community's interest in and involvement with the Leetown Pesticide Site, including a discussion of concerns raised by community members and officials during remedial planning activities.

Section III: Summary of Public Comments Received During the Public Comment Period and Agency Responses - A summary of comments categorized by topic and followed by EPA responses.

Section IV: Remaining Concerns - A description of remaining community concerns that should be considered as the EPA and the State of West Virginia Department of Natural Resources (WVDNR) conduct the remedial design and remedial action at the Leetown Pesticide Site.

In addition to sections I through IV, a list of EPA community relations activities conducted at the Leetown Pesticide Site is included as Attachment A of this responsiveness summary.

I. OVERVIEW

The Remedial Investigation (RI) Report and the Feasibility Study (FS) Report were released to the public for review and comment on March 6, 1986. This marked the opening of the comment period, which extended to March 27. During the comment period, the EPA recommended a preferred remedial alternative from among the seven alternatives presented in the FS report.

The recommended alternative was described in detail in Section 3.0 of the report as Alternative No 7. This alternative consists of consolidating contaminated soils from three source areas into a specially-prepared treatment bed and saturating the soils with water to promote biological degradation of the pesticides. The progress of the biodegradation will be monitored until pesticide levels have been reduced to acceptable levels. The treatment bed will then be disassembled and the soils will be regraded to blend with the surrounding area. Post-closure groundwater monitoring would be conducted for two years.

Comments received during the public comment period suggest that the general public does not object to the recommended alternative and is supportive of the intent to restore the land to a usable condition. Local officials, however, objected to the remedial action alternative on the basis of cost. They voiced a preference for buying the property in question, fencing it, and restricting its use via restrictive covenants placed on the deed. EPA rejected this proposal on the grounds that land acquisition for the purpose of restricting its use was not permitted by EPA policy. In addition, EPA questions the fact that land use restrictions could be guaranteed via a covenant on the deed.

II. BACKGROUND OF COMMUNITY INVOLVEMENT AND CONCERNS

The Leetown Pesticide Site history is believed to date back to 1975. At that time, a fire occurred at the Miller Chemical Company plant in nearby Ranson, West Virginia. Sometime prior to 1981, pesticide-contaminated waste/debris allegedly resulting from that fire were placed on land presently owned by Julian and Luola Robinson (i.e., the Robinson property). It was also alleged that, at about this same time, debris from the fire were landfarmed on lands now belonging to Mr. Willard Lloyd, and termed the "suspected pesticide landfarm" in the RI Report.

Two orchards also formerly occupied lands within the area of the study. The largest of these, the former Jefferson Orchard, included about 170 acres of land on either side of Route 15/1 (Jefferson Road). Of this area, the land east of Route 15/1 included a 25-acre tract which is presently the Robinson property. The second orchard was the former Crimm Orchard, occupying a tract of about 46 acres to the southeast of the Jefferson Orchard. Both of these orchards included areas dedicated to the mixing of pesticides for spray application.

In addition to the foregoing areas investigated during the RI, there are two active landfills in the study area. These include the Jefferson County Landfill and a landfill associated with the West Virginia Department of Highways maintenance garage at the intersection of Routes 15 and 15/1.

Public attention was first focused on the site in April 1983, when local newspapers reported the removal of the pesticide pile on the Robinson property. The pile was removed by the Miller Chemical Company under the direct supervision of the EPA and WVDNR. Although cooperating in the cleanup action, Miller Chemical Company expressly denied any responsibility for the contamination emanating from the pile.

In August of 1984 approximately 40 residents attended a public meeting conducted by the EPA to discuss the Work Plan for the Remedial Investigation/Feasibility Study. Also, at about this time, three public forums on groundwater quality in the Shenandoah Valley were conducted by three separate interest groups: the League of Women Voters, State Representative Thomas Steptoe, Jr., and the local Region IV Planning Commission. Three local citizens' groups that expressed concern over the Leetown Pesticide Site were the Citizen's Action Group, the Jefferson County League of Women Voters and the Potomac Valley Chapter of the National Audobon Society.

Concerns expressed at the August 1984 public meeting included the following:

1. Concern that money was seemingly being wasted in singling out the Leetown Pesticide Site for scrutiny when the entire county and much of the state had been sprayed with DDT.

2. Concern that the RI/FS was possibly being performed to advance some hidden agenda of the National Fisheries Center, located within the general study area.

3. Concern that Jefferson County had an unusually high incidence of cancer, especially in young women.

4. Concern that the Jefferson County Landfill had been unfairly included in the study.

III. SUMMARY OF PUBLIC COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD AND AGENCY RESPONSES

Comments raised during the Leetown Pesticide Site public comment period are summarized briefly below. The comment period was held from March 6 to March 27, 1986 to receive comments from the public on the draft Feasibility Study (FS). The comments received during the comment period are categorized by relevant topics. At the time of the public comment period, EPA had focused on Alternative No. 7 (Onsite Treatment) as the preferred alternative.

Remedial Alternative Preferences

1. The Jefferson County Commissioners suggested that purchase of the property and institution of restrictive covenants on the deed to preclude access and/or tillage of the contaminated soils in the future could be an effective means of addressing public health concerns. The Risk Assessment performed as part of the RI Report indicated that unacceptable additional cancer risk would only occur in a situation in which individuals inhaled dust emissions from these areas during tillage.

   EPA Response: Beyond the fact that land purchase for the purpose of restricting access to contaminated areas is not an allowable use of Superfund monies, the EPA is concerned that restrictive covenants may not ensure that access is permanently controlled.

Technical Questions/Concerns Regarding Remedial Alternatives

1. One commentor questioned the depth to which pesticide contamination extends in the areas of contaminated soil, and further suggested that a possible means of control would be to plow the contaminated soils under, below the depth generally penetrated during normal tillage operations (6-8 inches)

   EPA Response: The depth of contamination by pesticides has been found to be about 6-8 inches, although additional investigation is necessary in those areas found to be contaminated at the surface to more precisely define the vertical (and horizontal) extent of contamination for the purposes of taking remedial action.

2. A commentor wanted to know the length of time required for DDT to degrade naturally in the environment.

   EPA Response: The exact duration required for complete degradation of the DDT is not known; however, it is known that one of the reasons for the persistence of DDT and other chlorinated hydrocarbon pesticides is their resistance to biodegradation. Biodegradation of these pesticides is optimized under anaerobic (i.e., without air) conditions; natural conditions are predominantly aerobic in the surface soils. One of the principles employed by the proposed biodegradation process outlined in the FS is to create an anaerobic environment to enhance the speed with which the pesticides are degraded.

3. A commentor questioned how the lead and arsenic levels found coincident with the organic pesticides would be handled by the onsite treatment technology.

   EPA Response: The preferred alternative will not reduce lead or arsenic levels. The lead and arsenic levels found coincident with the most intensive pesticide contamination appear to be consistent with levels documented by the literature and by field sampling at the Leetown Pesticide Site to occur in orchard areas. These levels of lead and arsenic apparently have resulted from use of lead arsenates as pesticides, and, therefore, did not arise as a result of disposal of hazardous wastes, but, rather, as a result of use of agrichemicals. Those levels found are consistant with orchard background levels in both the Leetown area and other orchards in the United States. Based on this, the decision not to mitigate levels of lead and arsenic has been made.

4. A commentor requested information regarding the contents of the drums in the former Crimm Orchard Packing Shed.

   EPA Response: The drums at the Crimm Orchard contained pesticide material The EPA presented an overview of the contaminant levels found at each of the suspected sources of contamination. For more detailed information regarding contaminant levels, the EPA referred the public to the RI Report which is available at the Charles Town Library, as well as in the offices of the County Commissioners.

5. A commentor asked where the offsite disposal would occur, if required.

   EPA Response: There are a limited number of disposal sites approved for receipt of hazardous materials under the Resource Conservation and Recovery Act (RCRA). The only sites available in the northeastern U. S. are in Ohio and New York.

6. A commentor questioned the schedule for future activities, assuming approval of additional monies for Superfund.

   EPA Response: Following the close of the public comment period, EPA will prepare a formal Record of Decision (ROD) identifying the recommended alternative. As soon as the ROD is finalized and monies become available, EPA will initiate design of the alternative. Since this is a relatively simple design problem, a period of three to six months will be required for complete design. After selection of a construction subcontractor, about two months will be required for construction, assuming favorable weather conditions.

7. One commentor questioned whether wastes other than those from the Leetown Pesticide Site could be placed in any onsite landfill constructed as part of remedial action at the sites.

   EPA Response: Any onsite landfill or capped deposit would be constructed with capacity only great enough to house contaminated soils and other contaminated materials from ancillary construction (e.g., roadways, decontamination pads) from the three sites identified. No other materials would be placed into the disposal areas.

Public Health/Environmental Concerns

1. One commentor asked whether the cumulative effect of all pesticides found at the Leetown Site had been considered in the development of the risk assessment.

   EPA Response: The EPA indicated that the risks had been estimated through a complex modeling process which takes into consideration all reasonable contaminant migration pathways, exposure durations, and exposed populations, and that cumulative effects had been considered.

2. A commentor questioned whether a health study (i.e., epidemiological study) had been done in concert with the RI/FS. Other commentors suggested that there is a cancer problem in Jefferson County, presumably as a result of the intensive orchard development in the area and the fact that many of the former orchards are presently the sites of residential developments.

   EPA Response: EPA indicated that no epidemiological study had been performed, and that, rather than focusing on past effects, the attempt in developing the risk assessment has been to estimate the risk to both the general public and the environment based on current levels of contaminants found during the RI, as well as postulated migration of these contaminants to potential receptors.

   The WVDNR indicated that mortality records necessary to investigate the incidence of cancer in Jefferson County could be obtained via the state public health office. This is, however, beyond the scope of the present study.

3. A former resident indicated that her domestic well had "gone bad" in 1980, exhibiting a "kerosene" odor, and that she was aware of four wells which had become unfit for use in the Leetown area. Although the NUS sampling of her well in August 1984 found no evidence of contamination, she indicated that the problem was most evident in the spring and fall during high water table conditions. This former resident complained of chronic health problems possibly attributed to the water quality in the domestic well. Although this individual has moved from the Leetown area, the well in question is still being used by the current occupant of the residence.

EPA Response: EPA indicated that the resident's well had been sampled and found to be uncontaminated, and that no further sampling had occurred to establish whether seasonal conditions may exert an effect on the contamination of the well.

4. Several commentors questioned the manner in which risks had been determined and asked whether an "acceptable" level of DDT residual in soil had been established.

   EPA Response: Risks were determined on the basis of detailed modeling of the various exposure pathways, with specific assumptions regarding the duration of exposure and type of exposure (i.e., dermal contact, inhalation, ingestion) to the various receptors. The actual calculations are available in Appendix E to the RI Report. No specific "acceptable" level of DDT residual in soil was found. Action levels, that is, target levels for remediation of the site to reduce the risk to an acceptable level, are reported in Section 8.0 of the RI Report.

5. One commentor asked if beef cattle had been included in the risk assessment scenarios.

   EPA Response: Beef cattle were not specifically included in the risk assessment calculations. However, the major commodity produced from livestock in the immediate site area is milk. Calculations were performed to demonstrate that the risk to the general population from ingesting milk produced from cattle in the site area was within acceptable limits.

6. In response to item no. 5 of this section, a commentor questioned whether milk from the dairy cattle had actually been tested.

   EPA Response: Under the scope of work of the site investigation EPA's objective was to determine whether the pesticide residual levels in the soil could produce a health risk via ingestion of milk from cattle grazing on such areas and/or fed silage produced on these areas. No specific authority exists for EPA to engage in a program of monitoring of pesticide levels in milk from dairy cattle. Periodic monitoring is undertaken by the Maryland and Virginia Milk Producers Association and severe penalties are imposed on those members of the association whose milk is found to contain pesticides in excess of the acceptable threshold limits.

7. Commentors asked whether studies had been done to determine the levels of pesticides which might be expected to be found in garden crops. In particular, one former resident indicated that her family garden had been adjacent to the Crimm Orchard property to the west.

   In addition, commentors questioned how the dairy cattle acquired the pesticides in their systems.

   EPA Response: Uptake of pesticides by garden vegetables is specific to the particular vegetable crop being considered. EPA did sample and analyze corn grain from the suspected pesticide landfarm area, and did not find pesticides in the grain above detectable limits.

With respect to the garden adjacent to the Crimm Orchard, while the garden may have been adjacent to the orchard, the most intensive contamination found at the orchard was at the former packing shed, which is located in the central portion of the property, a significant distance from adjacent properties to the west.

Based on previous studies, little systemic uptake of pesticides has been recorded in corn. Cattle appear to acquire pesticides through actual ingestion of contaminated soils.

8. Several commentors noted that abandoned orchards in the Leetown area were now housing developments and questioned what would happen if the orchards within the study area were put to the same use.

   EPA Response: EPA noted that the only exposure pathway found in conjunction with the contaminant levels at the study area sites to produce an unacceptable health risk was that of inhalation of dust emissions from tillage operations. If the areas were to become housing developments, the same considerations would prevail relative to activities which would generate dust emissions. However, the final risk level presented from tillage operations is a chronic level based on 40 years of annual tilling and inhalation of the dust particles. Construction activities associated with development would not take place over a long period of time. Therefore, the shortened exposure duration greatly reduces the associated risk.

Public Participation Process

1. One commentor questioned whether March 27 was the final date for submission of comments, and also what form the submission had to take.

   EPA Response: March 27 is the final date for receipt of comments. These comments can be either written or verbal. Names and phone numbers of EPA contacts for submission of comments were provided to those attending the meeting.

Costs/Funding Issues

1. A commentor asked for clarification between Alternative No. 7 (Onsite Treatment) and Alternative 6B (Offsite Disposal with Treatment), inferring that the only difference was in the higher cost of the latter alternative ($7M vs $1M).

   EPA Response: EPA indicated that while both alternatives would achieve destruction of the wastes, the onsite treatment alternative would not require transport of the contaminated soils over great distances on public highways, with the attendant risk of accidental spillage. Onsite treatment via biodegradation would also not require permanent containment of the soils, as would be the case with the offsite disposal option. Even if the soils could be successfully treated via incineration to remove the pesticides, it is likely that the residual ash would require special handling as a hazardous waste in view of its heavy metal content.

Use of a RCRA-approved hazardous waste landfill to store the materials would be required. Space at such landfills is currently at a premium, and one of EPA's goals in site remediation is to destroy wastes without the need for their transport to RCRA-approved facilities.

Other Issues

1. A number of commentors indicated that mixing areas such as those identified at the former Crimm and Jefferson Orchards during the RI exist throughout Jefferson County. In particular, one commentor indicated that "at least 20" such areas exist. In reference to the Leetown Pesticide Site, one commentor suggested that pesticides had been mixed at the intersection of Routes 1 and 15 and Hopewell Run in Leetown, proper.

   Another commentor indicated that the "largest orchard in the world" had at one time operated about 2 miles south of the Leetown area, occupying a total of about 3,000 acres.

   EPA Response: EPA indicated that there are three separate groups involved in Superfund Sites: 1) Site Discovery, 2) Emergency Response, and 3) Remedial Planning. Information relative to new sites should be directed to the Site Discovery Group for appropriate action. It would not be appropriate to attempt to address each of these areas in conjunction with the present site. The WVDNR further suggested that it would be interested in following up on information about such hazardous waste activities.

2. One commentor questioned whether the property owner (i.e., Luola Robinson) would be reimbursed for temporary or permanent use of her property for remedial action.

   EPA Response: Superfund does not make any provision for compensating individuals for temporary or permanent loss of property as a result of remedial action. The EPA went on to indicate that the present instance is somewhat unusual, since normally the property taken in remedial action is a part of the hazardous waste site, instead of that of a private citizen (i.e., the Robinsons).

3. A commentor asked for definition of the liability conferred by law on the person or firm that placed the pesticide contamination on the land.

   EPA Response: EPA conducts a search for potential responsible parties (PRPs) at Superfund Sites. This search is presently in progress for the Leetown Pesticide Site. After PRPs are identified, they are given the opportunity to undertake the recommended remedial action defined by the EPA following completion of the FS. If they decline, EPA will take the necessary action, using monies from the Superfund, and will then attempt to recover these costs from the PRPs.

4. A commentor asked whether the monitoring wells installed around the landfill would be used for further monitoring, and, if so, who would pay for the analyses.

EPA Response: The landfill monitoring wells are available for use by either the WVDNR or Jefferson County for future monitoring activities.

Mr. Lee Snyder, manager of the Jefferson County Landfill, indicated that the County Commissioners were strongly considering monitoring, and that the cost of analyses would be reduced by focusing on parameters which would indicate the possibility of groundwater contamination by the landfill. If indications were found that contamination was occurring, then more detailed analyses could be performed to characterize the exact chemical constituents of the contamination.

IV. REMAINING PUBLIC CONCERNS

Issues and concerns expressed during the comment period that the EPA was unable to address during remedial planning activities include:

1. Concern remains that many pesticide mixing areas other than at the Crimm and Jefferson Orchards have not been identified and that these areas may have been or eventually will be developed for residential use.

   EPA indicated that information about unidentified sites should be reported to the EPA Site Discovery Group for appropriate action. WVDNR also expressed interest in learning about such sites.

2. Concern remains that human health may have been affected by this site. One family, in particular, noted an increase in health problems during periods of high water table conditions, and other residents expressed concern that the county had a high incidence of cancer.

   WVDNR indicated that mortality records were kept by the state public health office regarding the incidence of cancer in the county. These records are available to the pubic.

3. The county commissioners remain concerned that federal funds are being wasted. They continue to feel that the land should be purchased and its use restricted.

   At this time, it is EPA's policy not to use Superfund monies to purchase land for the purpose of isolating contamination from the public or the environment through total land use restrictions (except possibly for the purpose of human relocation issues). EPA also stated that the agency's intent is to restore the use of the land in question, not to place permanent constrains on its use. Furthermore, there is the possibility that the restrictions on use may not be strictly observed.

Attachment A

Community Relations Activities Conducted At The Leetown Pesticide Site

- A press release announced the public meeting to discuss the upcoming RI/FS activities, August 1984.
- An RI/FS fact sheet was distributed to interested parties, August 1984.
- A public informational meeting was held at the Jefferson County Court House on August 23, 1984.
- EPA met with the local public health officer to discuss sampling plans, November 1984.
- EPA met with county commissioners to advise them of the dye injection process planned for site-related groundwater studies. Agency personnel also went door-to-door in the immediate study area to explain the process to residents who might be affected, July 23, 1985.
- A press release announced the availability of the draft RI and FS reports at local repositories. It also announced the opening of the comment period and the upcoming public meeting, March 1986.
- Fact sheets identifying the preferred remedial alternative were mailed to interested parties, March 1986.
- A public meeting to discuss the preferred remedial alternative was held on March 20, 1986.